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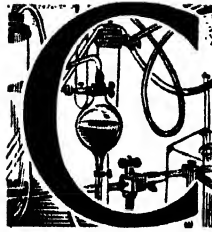


COMPLETE IN THIRTY VOLUMES

AMERICANA CORPORATION

NEW YORK CHICAGO WASHINGTON, D.C.

VOLUME VI
CASTE—CIVIL LAW



CASTE, *kāst*, one of many hereditary units in the social systems of India, Pakistan, and Ceylon. Membership in a caste can be obtained only through birth and cannot later be changed. Avoidance or denial of caste affiliation may be achieved by moving out of the region where one's caste exists, but by no other means. Social action may ostracize a person from his caste, but this does not free him to take up affiliation elsewhere. Despite agreement on these features of caste, the word is now used in two different ways.

In its more generalized sense, caste is coupled with class and refers to any group, the membership in which is determined by heredity, with a socially recognized advantage or disadvantage in status and privilege. Thus one caste is superior, or inferior, to another and individuals within it are consequently aided, or hampered, in their personal struggle for position, wealth, and social recognition. It is assumed when the word is used in this way that the persons in a society generally desire the same things. When the attainment of these goals is regularly helped or hindered by certain accidents of birth, castes develop and some individuals' opportunities for success are limited according to circumstances beyond their control. Caste is frequently regarded by people who use the word in this way as a symptom of enforced social inequality and as such is something to be eradicated or, at the very least, alleviated.

In its more precise meaning, caste refers to the social units within the highly complex social systems of India, Pakistan, and Ceylon. The caste system of these countries has existed for well over 2,000 years. It is in connection with this system that the Portuguese word *casta* attained its present wide application as English *caste*, and it is from this that the usage described above derived. The term used in the sense of a frozen class system is normative as well as descriptive, and reflects the powerful impression made by the actual caste system upon Western observers. As early as 1871, Sir Henry Maine wrote: "I am aware that the popular impression . . . is that Indian society is divided, so to speak, into a number of horizontal strata, each representing a caste. This is an entire mistake. . . . The true view of India is that, as a whole, it is divided into a vast number of independent, self-acting, organised social groups. . . ." (*Village Communities in the East and West*, pp. 56-57, London 1872). Since Sir Henry's day, caste as class has developed a literature and social theory of its own. The fact that

it did not offer an accurate view of Indian society was often neglected. Caste came to be used indiscriminately by Westerner and Indian alike to refer to an established social order and to a situation fostering social injustice. Many historical and sociological factors, particularly during the last several centuries, have, indeed, influenced caste in the subcontinent in the direction of class. Considering these changes, it is little wonder that the frame of reference has frequently been, and often still is, confused.

In contrast, the traditional view of caste is explicitly stated in treatises on Hindu law. The classic among these is the Code of Manu, generally dated between 200 B.C. and 100 A.D. but known to be founded on material of earlier date. In these and other sacred writings of Hinduism from the time of the Rig Veda (about 2000 B.C.) onward the word used to refer to caste is *varna* (Sanskrit *varṇa*). All of society is conceived as being composed of five interdependent divisions. The first four are the *varna*: (1) the Brahmins, or priests and scholars; (2) the Kshatriyas, or warriors and rulers; (3) the Vaisyas, or husbandmen, merchants, and artisans; and (4) the Sudras, or servants. The fifth division is composed of outcastes. According to the Hindu doctrine of rebirth, these are among the stages through which the soul passes. The first three *varna* are "twice born" because their members undergo an initiation ceremony not permitted to Sudras. They then wear the sacred thread as a sign of initiation, may study the Veda, and perform the sacraments. Sudras may be further distinguished as to whether or not they are "clean." It is important to note that the opposite of "clean" is not "dirty," but "unclean." Cleanliness in this sense refers to ritual only, and the unclean are those who are ritually polluting. Contact with them, whether direct or indirect, must be counteracted by ritual purification before the ordinary activities of life may be resumed. The *varna* are said to have originated from the deity: the Brahmin sprang from the mouth, the Kshatriya from the arms, the Vaisya from the thighs, and the Sudra from the feet.

Though this account of caste, recorded in Sanskrit literature, is recognizably tied to Hindu doctrine, it is, in a strict sense, more characteristic of Brahmanism, for there are important Hindu sects which are opposed to much of Brahmanic philosophy, especially as related to caste practice. Nevertheless, Brahmanism has had an extremely important influence. Groups which fall outside of its direct orbit, such as tribal

groups and members of other religious faiths, can be seen to bear its imprint. As some writers have pointed out, there has been a gradual Sanskritization of even non-Hindu peoples and a general dissemination of Brahman ethics in the subcontinent.

The hereditary units of the caste system are known as *jati* (Sanskrit *jāti*). They are many in number (between 2,000 and 3,000) and, according to Hindu doctrine, have arisen through the splitting of the *varna*. Whatever their origin, castes are present in all the major populations of the subcontinent. Throughout the period of historical Hinduism, there have been movements opposed to caste, such as Buddhism, Jainism, and Sikhism. The beliefs of Islam, which entered Sind as early as the 8th century, deny caste. And more recently, the attempts of followers of Gandhi to relieve the social position of the outcastes, or untouchables, have culminated in the absolute prohibition of untouchability in the Constitution of the Republic of India. Nevertheless, castes as social units have existed within groups denying the caste philosophy.

Despite their actual number, castes in any one locality are arranged in hierarchical order. Each person knows the relative position of his caste. Although certain positions may be in doubt at any one time, with a few castes claiming greater recognition and others accepting degradation, no caste is so low that it cannot refer to another below it in the hierarchy. One of the Brahman castes is generally at the top, but in some regions another, often a militaristic group, may claim ascendancy. Moslems (Muslims) may constitute a single caste in a dominantly Hindu population or, as in parts of Pakistan, Hindu and Moslem castes may interlace in the hierarchy. In the south of India, where caste regulations are exceptionally rigid, some castes are regarded as *Right Hand* and some as *Left Hand* castes. Not all castes in the south belong to these divisions, but the rivalries between them sometimes spread beyond them.

The lines between the castes are clearly demarcated by the rules of pollution. Most important among these are rules concerning the taking of food and water. Restrictions concerning *pakka* dishes, those cooked with ghee (clarified butter), are less severe than those for *kachcha* foods, which are cooked with water. Every caste knows those castes from which its members can accept food and those from which they cannot. If these rules are relaxed by the individual, it is always with the consciousness that he is doing so. Caste members may eat with each other, and marriages are also regularly arranged within the caste. Except in cases of hypergamy, where a bridegroom is sought from a higher-ranking caste, marriages are regularized within the caste. Each caste, however, contains *gotras*, or subcastes within which marriage would be regarded as incest. Marriage within caste must also be across *gotra*.

Castes regulate these matters themselves. They also have their own rituals, beliefs, and restrictions or privileges, concerning which no one has the right to dictate. Castes are thus largely autonomous, and they tend to be interdependent in practice since each has its own traditional areas of economic and social specialization. Caste names are often synonymous with the names of occupations such as washerman, goldsmith, barber, accountant, marriage go-between, vegetable

farmer, toddy tapper, or musician. Not all members of a caste need always follow its traditional specialization. But a consistent and recognized shift in either practice or specialization brings about a shift in caste definition and ranking. Such changes are still in many cases regulated by caste panchayats or councils. When caste panchayats were more powerful, they also always served as disciplinary bodies, intracaste disputes being handled by village or cross-caste councils.

Today, in the newly born nations of the subcontinent, caste regulations are subject to foreign—and potent—forces. Yet many aspects of the social order continue to encourage the formation, and the vitality, of hereditary, interdependent, and self-acting units within the greater whole of society. See also INDIA—*Anthropology and Sociology*, and *Religion and Philosophy*.

Bibliography.—For an example of the use of caste as class see Tumin, Melvin M., *Caste in a Peasant Society* (Princeton 1952). For a description of caste as social order see Hutton, John H., *Caste in India: Its Nature, Function and Origins* (Cambridge, Eng., 1952); and Ryan, Bryce, *Caste in Modern Ceylon* (New Brunswick, N. J., 1953). The last two contain extensive bibliographies.

MARIAN W. SMITH,
The London School of Economics and Political Science, University of London.

CASTEL GANDOLFO, kās-tēl' gān-dōl'fō, commune, Italy, in Roma Province, Latium; 13 miles southeast of Rome. It is famous as a summer resort of the popes. Built on the site of ancient Alba Longa supposedly founded by Ascanius, it is situated on the western edge of the Alban Hills, overlooking Albano Laziale, a crater lake. The area is rich in olive groves, orchards, and vineyards. During World War II the town was damaged in air raids.

The papal palace, in the Piazza del Plebiscito, was built in the 17th century on the ruins of an earlier castle and was designed by Carlo Maderno. Nearby, Villa Barberini, begun by Urban VIII, was built on the site of a villa belonging to the Roman emperor Domitian. Both the palace and the villa enjoy extraterritorial rights. Also in the Piazza del Plebiscito are the church of San Tommaso da Villanova (1661), which contains work of Giovanni Lorenzo Bernini, and a fountain executed by the same artist. The astronomical observatory, Specola Vaticana, was established in 1936. Pop. (1951) 4,212.

CASTEL SANT'ANGELO. See SAINT ANGELO CASTLE.

CASTELAR Y RIPOLL, kās-tā-lār' ē rē-pōl'y, Emilio, Spanish orator and statesman: b. Cadiz, Spain, Sept. 8, 1832; d. San Pedro del Piñatar, Murcia Province, May 25, 1899. He was professor of history and philosophy at the University of Madrid from 1856 to 1865 and, after a short exile, from 1868 to 1875. An active republican leader, he was foreign minister from September 1873 to January 1874 during the short-lived republic that followed the abdication of King Amadeus. Later during the reign of Alfonso XII he became a member of the Cortes. He had advocated a separation of the church and the state.

He published *La civilización en los cinco primeros siglos del Cristianismo* (1859), *Historia del movimiento republicano en Europa*, 2 vols. (1873-1874), *Historia del descubrimiento de América* (1892), *Discursos parlamentarios y*

políticos (1871-1873), and biographies of Lord Byron and Fra Filippo Lippi. However, he is principally remembered for his oratory: Castelar was the most renowned orator of 19th century Spain.

CASTELEIN, kās-tē-līn', **Matthijs de**, Flemish poet and critic: b. Pamele, near Audenaarde, Belgium, 1485; d. there, April 1550. A member of the Rederijkerskamers, or Chambers of Rhetoric, he was the acknowledged lawgiver for all Dutch grammarians; he set the pattern in his *Const van Rhetoryken* (completed 1548; published 1555), the first treatise on Flemish versification which also included some ballads and songs. He wrote over 100 plays, one of which was *Historie van Pyramus en Thisbe*.

CASTELFRANCO, **Giorgione da**. See **GIORGIONE**.

CASTELFRANCO DELL'EMILIA, kās-tēl-frāng'kō dēl-lā-mē'lyā, commune, Italy, in Moderna Province; about 7 miles southeast of Moderna. In 1628 Urban VIII erected, just outside the city on the Bologna frontier, a large fort which later became a prison. The town is the approximate site of the ancient Forum Galorum where Octavian defeated Mark Antony in 43 B.C. Milk products, wine, and paper are produced. Pop. (1951) 19,753.

CASTELFRANCO VENETO, kās-tēl-frāng'kō vā-nā-tō, commune, Italy, in Treviso Province; about 15 miles west of Treviso. The city is surrounded by medieval walls. Il Giorgione, who was born here, painted the altar-piece, "Madonna with St. Francis and St. Liberale," in the local cathedral. In 1805, near the Musone River crossing, the French defeated the Austrians. Manufactures include textiles, leather goods, pharmaceuticals, alcohol, and electrical equipment. Pop. (1951) 19,984.

CASTELLAMMARE DEL GOLFO, kās-tēl-lām-mā'rā dāl gōl'fō, seaport, Sicily, in Trapani Province; about 5 miles northwest of Alcamo. The port is located on a fertile coastal plain on the Gulf of Castellammare. It is a watering place and has small tuna fisheries. Pop. (1951) 18,740.

CASTELLAMMARE DI STABIA, kās-tēl-lām-mā'rā dē stā'byā, seaport, Italy, in the Province of Nāpoli; about 16 miles southeast of Naples, to which it is connected by railroad and highway; it extends for over a mile along the southeast end of the peninsula of Sorrento. Because of its beautiful location, its sea bathing facilities, and the variety of its mineral waters, used since Roman times, it is much visited by tourists. Vineyards and fruit and vegetable orchards cover its pleasant surroundings. The local shipyards, established by the Bourbons in 1783, are one of the oldest in Italy; after 1900 they were enlarged and modernized. Macaroni, cheese, alcohol, rope, canned goods, and olive oil are the chief products; fishing is also important. There is a 16th century cathedral, a municipal palace, and the restored remains of the 13th century castle of Frederick II. The Villa Quisisana, built on a height by the Angevins, is now a hotel and offers a gorgeous view of the bay. The town lies on the site of ancient Stabiae

which was destroyed by the eruption of Mount Vesuvius in 79 A.D.; near here Pliny met his death. In 1779 the French, under Jacques E.J.A. Macdonald, defeated the British and Neapolitans. Pop. (1951) 56,115.

CASTELLANA, kās-tāl-lā'nā, commune, Italy, in Bari Province; 16 miles southeast of Bari and about 7 miles from the Adriatic. It is located in the fertile Apulia plateau where olives and vines are grown; macaroni and textiles are manufactured. Pop. (1951) 13,850.

CASTELLANE, kās-tēl-lān, **COMTE Esprit Victor Elisabeth Boniface de**, French marshal: b. Paris, France, 1788; d. Lyon, 1862. He entered the army in 1804 and took part in most of Napoleon's campaigns. In 1815 he became a colonel of the hussars of the royal guard and following the siege of Antwerp (1832) was made lieutenant general. However, he opposed the revolution, lost his command, and consequently went over to Louis Napoleon for a short time. After his return, he was made commander of Lyon in 1850 and two years later became marshal of France. His *Journal* was published in 1897.

CASTELLANI, kās-tāl-lā'nē, **SIR Aldo**, Italian bacteriologist: b. Florence, Italy, Sept. 8, 1875. He studied at the universities of Florence and Bonn and at the London School for Tropical Medicine. Working in Uganda with two British physicians, Sir David Bruce and David Nunes Nabarro, he discovered in 1903 *Trypanosoma gambiense*, the organism causing sleeping sickness, and in 1907 described *Treponema pertenue* as the cause of yaws. In 1926 and 1932 he was professor of tropical medicine at Tulane and Louisiana State universities, respectively. He has published several books, among which is *A Manual of Tropical Medicine* (with Albert John Chalmers, 1910), and edited the *Journal of Tropical Medicine*. He developed Castellani's absorption test, and Castellani's disease, a bronchial spirochetosis, is named for him. In 1929 he was knighted in England and he has received numerous honors in Italy. During the Ethiopian campaign he was surgeon general for the Italian forces.

CASTELLESI, **Adriano**. See **ADRIAN OF CASTELLO**.

CASTELLI, kās-tēl'lē, **Benedetto**, Italian mathematician and physicist: b. Brescia, 1577; d. Rome, c.1644. He entered the Benedictine Order and was abbot at Monte Cassino. A pupil of Galileo, he became a successful professor of mathematics at the University of Pisa and at the Collegio della Sapienza, Rome. He distinguished himself in the field of hydraulics and was consulted by Urban VIII in his projects for the regulation of Italian rivers. Torricelli was one of his pupils. *Della misura delle acque correnti* (Rome 1628), his principal work, was translated into English in 1660 and into French in 1664.

CASTELLI, kās-tēl'ē, **Ignaz Franz**, Austrian dramatist: b. Vienne, Austria, March 6, 1781; d. there, Feb. 5, 1862. As a writer of patriotic songs, he gained considerable recognition with the publication of his *Kriegslied für die*

österreichische Armee. In 1811 he was appointed court poet to the Kärntner Theater in Vienna, but in 1815 went to Paris as secretary to Count Cavriani. Upon his return he resumed his former position.

He composed librettos for Joseph Weigl's *Die Schweizerfamilie* (1809) and Schubert's *Die Verschwornen* and adapted Meyerbeer's *Huguenots*. He founded *Allgemeiner musikalischer Anzeiger* and was its editor from 1829 to 1840. As a popular dramatist, his numerous plays were effective in their satirization of Viennese foibles. His last publication was *Memoiren meines Lebens*, 4 vols. (1861–1862).

CASTELLIO, kās-těl'i-ō, or **CASTALIO**, kās-tā'li-ō, **Sebastianus** (Fr. SÉBASTIEN CHÂTILLON, shā-tē'yōn, or CHÂTEILLON, shā-tā'yōn), French Protestant theologian and humanist: b. Saint-Martin-du-Fresne, Ain, France, 1515; d. Basel, Switzerland, Dec. 29, 1563. At the invitation of Calvin he settled in Geneva where he became rector of the college in 1541. But because of differences regarding questions of religious belief, especially his erotic interpretation of the Song of Solomon, he was banished and settled in Basel in 1545 where he spent the remainder of his life. In 1553 he became professor of Greek at the university, and the following year wrote, under the pseudonym of Martin Bellie, his famous condemnation of the execution of Servetus in both Latin and French, *De haereticis et Traité des hérétiques*. He made two remarkable translations of the Bible, one in Latin, the other in French.

CASTELLO, kās-těl'lō, **Giovanni Battista** (called IL BERGAMASCO, ēl bār-gā-mās'kō), Italian painter, sculptor, and architect: b. at or near Bergamo, Italy, c.1509; d. Madrid, Spain, 1569, although 1579 is sometimes quoted. He belonged to the school of Genoese painters, but apparently was unrelated to other artists of the same name. Invited to Madrid as architect of the royal palaces by Philip II, Castello assisted in the restoration of the Alcázar and the construction of the Escorial.

CASTELLON DE LA PLANA, kās-tā-[l]yōn' dā lā plā'nā, province, Spain, on the Mediterranean coast; 2,579 square miles. The northern and western mountainous regions slope down to the fertile coastal area, which is still irrigated by canals dating from Moorish times; the province is drained by short torrential rivers. Essentially an agricultural district, its products include grapes, olives, grain, fruits, and vegetables, especially oranges and rice; there are few minerals. Textiles, porcelain, cement, soap, and paper are the principal manufactures; sericulture and hemp processing are also carried on. El Grao de Castellón and Vinaroz are the two important ports. Pop. (1950) 325,091.

CASTELLON DE LA PLANA, city, Spain, capital of the province of the same name; 40 miles north-northeast of Valencia and 200 miles east-northeast of Madrid. It is located in a fertile irrigated plain, producing citrus fruit, olive oil, wine, cereals, and rice. Cement, sandals, and tiles are manufactured. The town is connected by railroad with its port, El Grao de Castellón, only three miles to the east; oranges, hemp, and tiles are exported. The present town

is entirely modern; the original town, now in ruins, occupied a hill to the north. James I of Aragon wrested it from the Moors in 1233. Later it suffered under the *comuneros*' rising in the 16th century and again in the 19th century during the Peninsular War. In 1938 it fell to the forces of Francisco Franco during the Spanish Civil War. Pop. (1950) 53,331.

CASTELLORIZO, island, in Mediterranean Sea. See KASTELORRIZON.

CASTELNAU, kās-těl-nō', **COMTE DE** (FRANCIS DE LA PORTE), French traveler: b. London, England, 1812; d. Melbourne, Australia, Feb. 4, 1880. He traveled extensively in Canada, the United States, and Mexico, and under the protection of the French government undertook an exploration of South America in 1843. After his return to France in 1847, he published *Expédition dans les parties centrales de l'Amérique du Sud* (1850–1861). Castelnau later traveled in Arabia and was successively consul at Bahia, the Cape of Good Hope, and Singapore. At the time of his death he was consul general at Melbourne.

CASTELNAU, Michel de (SIEUR DE LA MAUVISSIÈRE), French soldier and diplomat: b. Mauvissière, Touraine, France, c.1520; d. Joinville, 1592. Of a noble family, he traveled in Italy as a youth and fought in Piedmont under Charles de Cossé, the future Marshal de Brissac. He conducted important diplomatic missions in Switzerland, the Netherlands, Germany, England, and Rome, and fought in the wars of religion from 1560 to 1565. In the latter year he was sent as envoy to Scotland, and in 1572 to England. For a decade from 1575 he was ambassador at the court of Queen Elizabeth, during which time he endeavored to negotiate a marriage between the queen and the duc d'Alençon. His *Mémoires* cover only the period 1559–1570.

CASTELNAU, kās-těl-nō', **VICOMTE Noël Marie Joseph Édouard de Curières de**, French general: b. Saint-Affrique, France, Dec. 24, 1851; d. near Toulouse, March 19, 1944. He entered the Saint-Cyr military school in 1869, served as an officer in the Franco-Prussian War, rose through the successive ranks, studied at the École de Guerre, and was promoted general in 1906. He became chief of staff of Gen. Joseph Jacques Césaire Joffre when, in 1913, the latter was designated as commander in chief in case of war. At the beginning of World War I, Castelnau was placed in command of the army of Lorraine, charged with the defense of Nancy. His forces, drawn up across the gap of Nancy to prevent the army of the crown prince of Bavaria from turning the Allied front, resisted a fierce assault by the Bavarians against the heights of Grand Couronné (Sept. 6 to 12, 1914). By his successful defense of Nancy, Castelnau contributed directly to the victory of the Marne. In 1915, he commanded the French offensive in Champagne and was made chief of the General Staff under the commander in chief. In 1916, he was sent by Joffre to Verdun and saw clearly the need for defending that fortress on the right bank of the Meuse. His recommendations were instrumental in the decision to hold Verdun. After the war, General Castelnau, who was a devout Catholic and an extreme conservative, be-

came active in rightist politics. He served as a deputy in the National Assembly from 1919 to 1924.

CASTELNAU, Pierre de, French ecclesiast: d. Jan. 15, 1208. Archdeacon of Mauguellonne, near Montpellier, he was sent in 1199 by Pope Innocent III, with two Cistercian assistants, to the south of France on a mission to convert or extirpate the Cathari heretics there, who were under protection of Count Raymond VI of Toulouse. After three years of efforts, the archdeacon took the Cistercian habit at Fontfroide, near Narbonne. Thereafter the pope confirmed him as apostolic legate and first inquisitor, and he resumed his labors. At a last stormy interview with Raymond, Castelnau excommunicated the uncooperative count. Shortly afterward one of Raymond's squires, thinking to please him, murdered the legate at an inn on the Rhone. The pope was so enraged at this crime that he proclaimed the "crusade" against the Albigenses (q.v.) conducted with such barbarity.

CASTELNAUDARY, kās-tě'l'nō-dā-rě', commune, France, in the Department of Aude, on a height above the Canal du Midi; 22 miles west-northwest of Carcassonne. It was built by the Visigoths on the site of a former town and was called *Castrum Novum Arianorum* from which its present name has been corrupted. It suffered greatly during the crusade of Simon IV de Montfort l'Amaury against the Albigenses and was captured in 1212; in 1355 it was almost totally destroyed by Edward the Black Prince. It is also famous for the battle fought beneath its walls on Sept. 1, 1632, the troops of Louis XIII defeating Gaston d'Orléans. The town has large grain and flour markets and does a considerable trade in fruit, wool, wine, and cattle; various forms of tiles and earthenware products are manufactured. Saint-Michel, a 14th century church, is located here. Pop. town (1946) 8,073.

CASTELNUOVO, CONTE DI. See **CARMAGNOLA**.

CASTELNUOVO, kās-tāl-nwó'vō, **Enrico**, Italian novelist: b. Florence, Italy, Feb. 16, 1839; d. Venice, Jan. 22, 1915. He spent the greater part of his time in Venice which set the atmosphere for most of his novels. Considered among his best works are *Il professore Romualdo* (1878), *Reminiscenze e fantasie* (1885), and *Il fallo di una donna onesta* (1897).

CASTELNUOVO-TEDESCO, **Mario**, Italian composer: b. Florence, Italy, April 3, 1895. Having studied composition with Ildebrando Pizzetti and piano with Edgardo del Valle de Paz, at the age of 15 he wrote a piece for the piano, *Cielo di settembre*. Among his other works are *La Mandragola* (1926), an opera, *Le Danse del Re David* (1925), *Concerto Italiano* (1924), for the violin and modeled on Italian folksongs, and *Concerto* (first performed 1928), for the piano. His music is programmatic and is harmonic rather than contrapuntal; the shorter forms, especially songs, were his specialty. He made his home in the United States.

CASTELO BRANCO, kās-tě'l'ōō brāng'-kōō, **Camilo** (also **CAMILLO CASTELLO BRANCO**; **VISCONDE DE CORREIA-BOTELHO**, kōōr-rā'yā bōō-

tā'lyōō), Portuguese novelist and poet: b. Lisbon, Portugal, March 16, 1825/1826; d. São Miguel de Seide, Minho, June 1, 1890. Orphaned at an early age, he was taken to a village in Tras-os-Montes by his sister where he led an erratic life. He studied for several professions but after a short journalistic career he took minor orders. His restless nature, however, prevented his adherence to this course, and he abandoned it to resume a feverish literary activity. In 1885 he was created a viscount in recognition of his literary accomplishments. Five years later, having lost his sight and suffering from a nervous disease, he committed suicide. He was particularly known for his novels of manners such as *Amor de perdição* (1862) and *Amor de salvação* (1864).

CASTELO BRANCO, kās-tā'l'ōō vrāng'-kōō, commune, Portugal, capital of Beira Baixa Province; 114 miles northeast of Lisbon. It is an agricultural trading and processing center; manufactures include woolen goods, candles, pottery, and furniture. Its episcopal palace with its formal gardens is of interest. Pop. (1940) 9,293.

CASTELVETRANO, kās-tě'l-vā-trā'nō, commune, Sicily, in the Province of Trapani; 29 miles south-southeast of the town of Trapani, on a rocky hill about 8 miles from the sea. Wine is the chief agricultural product, and furniture is the most important manufacture. The ruins of the Greek city Selinus are nearby. Pop. (1951) 30,195.

CASTELVETRO, kās-tāl-vā'trō, **Lodovico**, Italian critic and philologist: b. Modena, Italy, about 1505; d. Chiavenna, Feb. 21, 1571. His works include a translation and commentary on Aristotle's *Poetics* (1570), and expositions on Cicero's *Rhetorica* (1553), Dante, and Petrarch.

CASTI, kās'tě, **Giovanni Battista**, Italian poet and adventurer: b. Acquapendente, Italy, Aug. 29, 1724; d. Paris, France, Feb. 5, 1803. Having studied and taught at the seminary in Montefiascone, he became court poet in Florence in 1764. There he met Emperor Joseph II, who liked his wit and personality and took him to Vienna in 1769. Casti went to Russia in 1778 and was received by Catherine II with great honors. This, however, did not prevent him from satirizing her in his *Poems Tartaro* (1787), for which Joseph II exiled him. He returned, however, to become poet laureate from 1790 to 1796, finally settling in Paris in 1798. The first to write truly original comic operas in Italian, Casti's fame rests mainly on his *Novelle Galanti* (1793, corrected edition), a collection of 48 short stories in verse. Most are of a licentious turn, as in his poem *Animali Parlanti* (1802), in which, through imaginary antediluvian animal characters, he symbolizes the conflict between the conservative regimes and the revolutionary ideas to which he was sympathetic.

CASTIGLIONE, DUC DE. See **AUGEREAU**, **PIERRE FRANÇOIS CHARLES**.

CASTIGLIONE, kās-tě-lyō'nā, **CONTE Baldassare**, Italian diplomat and writer: b. Casatico, near Mantua, Italy, Dec. 6, 1478; d. Toledo, Spain, Feb. 7, 1529. He studied in Mantua and

at the age of 18 entered the service of Duke Ludovico Sforza. In 1499 he became attached to the service of Francesco Gonzaga, duke of Mantua, whom he accompanied on an unsuccessful campaign in Spain. Five years later he transferred to the small but brilliant court of Guidobaldo II, duke of Urbino. Here in a relaxed but intellectual atmosphere he was able to devote much of his time to literary pursuits. He served not only as an accomplished courtier but also as a soldier and as an ambassador, and in 1506 was sent on a mission to Henry VII of England where he received the Order of the Garter for his duke. In Rome, he met and befriended Raphael, whose fine portrait, now in the Louvre, clearly reveals his personality. In 1524 Pope Clement VII sent Castiglione as papal nuncio to the court of Emperor Charles V who later offered him the bishopric of Avila. His Spanish mission is generally considered a failure, since it did not effect the desired reconciliation nor did it prevent the sack of Rome by the Bourbons in 1527; but at least part of the blame should go to the wavering attitude of the pope himself.

Castiglione was a true humanist and one of the most representative figures of the Italian Renaissance from an ethical, literary, and political viewpoint. His fame rests chiefly on his prose dialogue, *Il Cortegiano* (q.v.), in which he describes the true Italian gentleman of his time; it is considered one of the most important works of the 16th century. Sometimes known in Italian as *Il Libro d'Oro*, it was first printed by the Aldine Press of Aldo Manutius in 1528. The first English translation, made by Sir Thomas Hoby as *The Courtier of Count Baldessar Castilio* (1561), had a considerable influence on Sir Thomas Wyatt, Earl of Surrey, Sir Philip Sidney, and Edmund Spenser. Castiglione also wrote poems in Italian and Latin.

Consult Cartwright, Julia, *Baldassare Castiglione* (London 1908) for reference and bibliography.

CASTIGLIONE, CONTE Carlo Ottavio, Italian scholar: b. Milan, Italy, 1784; d. Genoa, April 10, 1849. He is best known for his edition of some of the fragments of Ulfilas' Moeso-Gothic Bible which were discovered in 1817 by Cardinal Mai. Castiglione also published a work in 1826 in which he sought the origin and history of the Barbary towns whose names appeared on Arabic coins.

CASTIGLIONE, Giovanni Benedetto (called *IL GRECHETTO*), Italian painter and etcher: b. Genoa, Italy, about 1610; d. Mantua, 1665.¹ A pupil of G. B. Paggi and G. A. De Ferrari, he was also influenced by Bernardo Strozzi, another leading painter of the school of Genoa. He was active in several centers but spent most of his life after 1639 at Mantua, where he was court painter of the duke of Mantua. Best known as a painter of animals, he chose religious and mythological subjects which allowed him to include large numbers of animals, such as Noah's ark, Abraham's journey, the nativity of Christ, pastoral myths and sacrifice scenes, as in the handsome *Ancient Sacrifice* in the Palazzo Durazzo in Genoa. His brother Salvatore and his son Francesco worked in his shop, the latter succeeding him as court

painter at Mantua. Castiglione's etchings are also well known, their free drawing and handling of light suggesting contact with Rembrandt's etchings.

Consult Delogu, G., *G. B. Castiglione detto Il Grechetto* (Bologna 1928).

CASTIGLIONE DELLE STIVIERE, *käs-tē-lyō'nā dāl-lā stē-vyā'rā*, commune, Italy, in Mantova Province; 22 miles northwest of Mantua. Located in the fertile Po plain, it is a busy agricultural market town; silk spinning is the principal industry. In 1404 it came under the Gonzaga, lords of Mantua, and was the seat of the principality under a branch of the family until early in the 18th century. Near here Napoleon won a decisive victory over the Austrians under Dagobert Siegmund von Wurmser on Aug. 5, 1796. Pop. (1951) 9,131.

CASTIGLIONE OLONA, [*käs-tē-lyō'nā olō'nā*], commune, Italy, in the Province of Varese; 27 miles northwest of Milan. The principal manufactures are cotton goods, textile machinery, and combs. The town is most famous for its frescoes by the 15th century Florentine artist Masolino da Panicale; the Collegiate Church, built by Cardinal Branda da Castiglione, contains the fresco of the life of Christ, and the life of St. John the Baptist is portrayed in the Baptistery. Pop. (1951) 3,643.

CASTILE, *käs-tēl'* (Span. *CASTILLA*, *käs-tē'-[l]yā*), region and former kingdom, Spain, traditionally divided into Old Castile (*Castilla la Vieja*) and New Castile (*Castilla la Nueva*), of which Burgos and Toledo were respectively the capitals. Burgos remains the capital of the modern region of Old Castile, but Madrid has replaced Toledo as capital of New Castile. The name "Castile" seems to have been derived from the numerous *castillos* (*castella* in Latin) constructed by nobles in that territory for defense against Moorish incursions during the Christian reconquest of Spain.

Occupying the geographic center of the Iberian Peninsula, New Castile included the Moorish kingdom of Toledo. Its present-day regional area, approximately that of the historic area, includes the five provinces of Ciudad Real, Cuenca, Guadalajara, Madrid, and Toledo. On the north it is bordered by Old Castile and Aragón; east by Aragón and Valencia; south by Murcia and Albacete; and west by Extremadura. It has an area of 27,933 square miles and a population of 3,559,809 (Dec. 31, 1950). The largest city is Madrid with a population of 1,618,435 (1950) and the next largest is Toledo (40,243). All the other cities have populations of less than 35,000.

Old Castile, adjoining New Castile to the north, is separated from it by the mountain barriers of the Sierra de Gredos, Sierra de Guadarrama, and Sierra de Ayllón. Historically its confines were even more vague and shifting than those of New Castile. In its present-day extent it comprehends the six provinces of Santander, Burgos, Logroño, Soria, Segovia, and Ávila. The region is boot-like in form, with Ávila the toe, Soria the heel, and the Bay of Biscay littoral of Santander Province the top. The largest city is Santander (102,464) and next largest Burgos (74,063), the regional capital. Few other cities, apart from provincial capitals, have populations in excess of 5,000.

¹ These dates have been regarded by modern scholarship as more nearly correct, although 1616-1670 have been repeated many times.

The greater part of Spain's central plateau is in Castile. The average elevation above sea level in New Castile is about 1,970 feet, while in Old Castile—the maritime province of Santander excepted—it is about 2,300 feet, and in the provinces of Burgos and Soria the elevation rises to 2,950 feet. Here are the headwaters of the Duero, Tagus, Guadiana and Júcar rivers. The plains of Castile are hemmed in on all sides by mountain ranges. The climate is continental—dry and very cold in winter, with temperatures recorded to $-64^{\circ}\text{F}.$; while summer temperatures rise to $117.6^{\circ}\text{F}.$ Winter snowfalls are heavy and the snows on the cordilleras last until April.

Largely arid and climatically unfavorable to agriculture, Castile is in the main a pastoral land. However, there is cultivation of cereals—chiefly wheat and barley, also potatoes, beans, and grapes. In southeastern New Castile the famous Valdepeñas, Tomelloso, and other wines are produced. Olive production is almost nonexistent, and no citrus fruit trees can be grown due to climatic conditions. The Castilian plain is treeless, ruthless felling having destroyed its ancient groves. What little forest growth remains in New Castile is in the mountainous parts of Cuenca where there are fairly extensive pine stands. On the other hand, in Old Castile there are numerous and extensive pine forests, especially in Soria and Segovia, which furnish large supplies of resin. This forest industry, with cattle raising, cheese-making, viticulture (in Burgos, Soria, and Ávila), vegetable and fruit canning in Logroño, cloth weaving for home consumption, wood exploitation (in Soria, Burgos, and Segovia), and milling, complete the picture of Old Castile's industrial activity.

In the southern part of Ciudad Real Province (New Castile) coal, mercury, and other minerals are mined in the vicinity of Puertollano and Almadén.

History.—According to tradition the first independent count of Castile was Fernán González (c.910–970). Before his time Castile had been ruled by vassals of the kings of Asturias and León who may have held the title of count. In 940 Fernán González revolted against King Ramiro II of León (r. 931–951), but was defeated and imprisoned. Several years passed before he recovered his liberty and countship. However, from 950 his name appears on Castilian documents without mention of the king of León, from which it is inferred that by then he had secured Castile's independence. A skillful politician as well as a warrior, he styled himself "Count by the Grace of God." In 955 he defeated the Moors at San Esteban de Gormaz.

The countship passed through various hands until it was seized by Sancho III, king of Navarre (r. 1000–1035), whose queen was a sister of Count García Sánchez of Castile, after the latter's murder in 1028. Sancho III also held the lordship of Aragon and conquered León. On adding Castile to his dominions, he raised it to the dignity of a kingdom and added to his own titles that of King Sancho I of Castile. In 1035 the crown of Castile passed to his second son who ruled as Ferdinand I (the Great). Four years later Castile and León were united. The two realms were separated in 1065, but in 1072 were reunited by King Alfonso VI (Alfonso el Bravo) of León who ruled Castile as Alfonso I. Subsequently the kingdoms were again separated but were finally reunited in 1230 under Ferdinand III (el Santo)

of Castile. Other noted kings of Castile include Alfonso X (el Sabio) and Pedro the Cruel. Isabella of Castile married Ferdinand of Aragon in 1469 and acceded to the throne of Castile in 1474, her husband becoming king of Aragon in 1479. Thenceforth Castile and Aragon were united in the Spanish monarchy. See also SPAIN—History.

CASTILHO, kâsh-tê'lyôo, VISCONDE Antônio Feliciano de, Portuguese poet: b. Lisbon, Portugal, Jan. 28, 1800; d. there, June 18, 1875. Although almost blind, he received his education with the help of his brother Augusto and later studied law at the University of Coimbra. His first poetical composition, *Cartas de Echo e Narciso* (1821), published while he was a student, won him great celebrity. He excelled in pastorals, to which class *A Primavera* (1822) and *Amor e Melancolia* (1822) belong. He was a leader of the romantic movement in Portugal. Among his other literary accomplishments are *A Noite do Castello* (1836), a translation of Ovid's *Metamorphoses* (1841), and a free adaptation of Shakespeare's *Midsummer Night's Dream* and Goethe's *Faust*.

CASTILIAN DIALECT, the official literary tongue of Spain. See SPAIN—Language.

CASTILLA, kâs-tê'yâ, Ramón, Peruvian soldier and politician: b. Tarapacá, Chile, Aug. 27, 1797; d. Arica, May 25, 1867. He fought in the war for independence (1820–1826) and in the civil war (1841–1845). In 1837, under President Augustín Gamarra, he was minister of war. Elected president of Peru in 1845, he was succeeded in 1851 by José Rufino Echenique, but overthrew him in 1855; three years later he was again elected to the presidency. He introduced several important reforms, such as the abolition of slavery (1856) and the promulgation of a new constitution (1860) which remained until 1920. In 1862 he was succeeded by Miguel San Román. See also PERU—History.

CASTILLA ELASTICA (known also as the MEXICAN RUBBER TREE, PANAMA RUBBER or ULE RUBBER), a member of the family Moraceae (Mulberry family), it is the principal source of rubber in Mexico and Central America. A fast-growing tree, especially when young, this species is characterized by large, oval, coarse leaves (18 x 6 inches), monoecious flowers, and fleshy, orange-red fruits (2 inches in diameter), composed of numerous drupes. The milky juice, which is obtained by tapping, coagulates in the air, a process often hastened by adding various plant substances. This crude rubber was well known to the early inhabitants of Mexico who made balls and other articles from it. It is also used for waterproofing of coats, hats, shoes, and other things. Cultivation of this and other species of the same genus, although attempted on a large scale, has not been so successful as that of other rubber-bearing plants, mainly because of the smaller yield and the difficulties encountered in tapping operations. The Mexican rubber tree is also used for medicinal purposes, and its bark is supposed to be a source of paper. Other species of the genus yield rubber exported from various Central American countries and especially Brazil. Although widely used, *Castilloa* is an incorrect version of the generic name.

CASTILLEJO, kās-tē-lyě'hō, **Cristóbal de**, Spanish poet: b. Ciudad Rodrigo, Salamanca Province, Spain, c.1490; d. Vienna, Austria, c.1550. Before the age of 15 he entered the service of Archduke Ferdinand, younger brother of Charles V, as a page. Upon the king's death in 1515 he became a monk at San Martín de Valdeiglesias where he remained until 1525 when he was made Archduke Ferdinand's secretary. While living in Vienna he led a rather licentious life despite his indescribable hardships. Endeavoring to remedy his plight, Charles V assigned him a 2,000-florin pension in 1548, but the poet died soon afterward. Although Castillejo does not rank among the lyricists of his time, few surpass his satiric venom and festive vein. Writing in the traditional style, facile, elegant, he satirized poets like Boscán Almogaver and Garcilaso de la Vega who were introducing the style and satirical combinations of the Italian poets. In addition to his versions of the Latin poets, he wrote numerous songs, ballads, and religious and moral works. Among his better known works are *Scrmon de Amores*, *Diálogo . . . de las mujeres*, and *Diálogo entre el autor y su pluma*, all of which are examples of his charming simplicity and delightful wit.

CASTILLEJOS, MARQUÉS DE LOS. See PRIM Y PRATS, JUAN.

CASTILLO, Bernal Díaz del. See DIAZ DEL CASTILLO, BERNAL.

CASTILLO, kās-tē'yō, **Ramón S.**, Argentine statesman: b. Catamarca, Argentina, Nov. 20, 1873; d. Buenos Aires, Oct. 12, 1944. The son of Rafael and Maria B. Castillo, he studied at the National University in Buenos Aires and became secretary of the Commercial Court of the City in 1893. Thereafter he held various legal and pedagogical positions. He entered politics in 1930 and was elected senator from Catamarca in 1932, serving until 1935. He successively held the posts of minister of public instruction and minister of the interior, and became vice president of Argentina and president of the senate in 1938. When President Roberto M. Ortiz resigned in 1940 because of ill health, Castillo became acting president, and president, governing by decree, after April 1941. Extremely conservative, he alienated Argentina from her sister republics by withholding cooperation in the United Nations in accordance with his policy of "prudent neutrality." He authorized repressive measures against the Argentine press, restricted labor, and curtailed civic liberties.

CASTILLO DE SAN MARCOS, national monument. See NATIONAL PARKS AND MONUMENTS.

CASTILLO NAJERA, kās-tē'yō nā'hā-rā, **Francisco**, Mexican physician and diplomat: b. Durango, Mexico, Nov. 25, 1886. The son of Romualdo Castillo and Rosa Nájera, he received his degree in medicine at the University of Mexico in 1903 and did further work in Paris and Berlin. He was director of the Juárez Hospital, Mexico City, 1918-1919, and in the latter year was professor of urology. In 1920 he became director of the army medical school and from 1921 to 1925 was a member of the international commission for the campaign against yellow fever.

In 1922 Castillo Nájera began his diplomatic career as minister to China, followed by the same position in Belgium (1927-1930), Holland (1930-1932), and France (1933-1935). He was ambassador to the United States from 1935 to 1945, at which time he returned to Mexico to become minister of foreign affairs. He served as Mexican delegate to the United Nations and in June and July 1947 was president of the Security Council.

CASTILLO SOLORZANO, kās-tē'lyō sāl-lôr'thā-nō, **Alonso de**, Spanish author: b. Torrellas, Spain, c.1584; d. probably at Zaragoza, about 1647. Although he published two volumes of humorous verse, *Donaires del Parnaso*, he is chiefly remembered as a novelist. Two of his works, *La niña de los embustes* (1632) and *Aventuras del bachiller Trapaza* (1634), were used in *Gil Blas* by Lesage. He also wrote several plays which were widely popular.

CASTILLON, kās-tē-yōn', or **CASTIL-LON-ET-CAPITOURLAN**, kās-tē-yōn' nā kā-pē-tōōr-lān', commune, France, in the Department of Gironde, on the Dordogne River; 26 miles east of Bordeaux. Beneath its walls, on July 17, 1453, was fought the battle which ended the Hundred Years' War, when the English met a defeat which resulted in the return of Gascony and Guyenne to France after being held by the English for nearly 300 years. Part of the battle was described by Shakespeare in the fourth act of *King Henry VI, Part I*. Pop. (1950) 3,071.

CASTINE, kās'-tēn, **Baron Vincent de**, French soldier: b. Oleron, France, 1650; d. there, about 1722. He went to Canada in 1665, established a mercantile house at Penobscot (now Castine), Me., in 1687, and married the daughter of the Penobscot chief. In 1696 he captured Pemaquid. He assisted in the defense of Port Royal in 1706 and was wounded there the following year. His son, who succeeded him in command of the Penobscots, was made prisoner and taken to Boston in 1721.

CASTING, the running of melted metal into a mold, so as to produce an object in metal having the shape of the mold. The casting of type is done by composing machines (q.v.). See CAST STEEL; FOUNDRY PRACTICE; and IRON—Cast Iron.

CASTING AWAY OF MRS. LECKS AND MRS. ALESHINE, *The*, a humorous story by Frank R. Stockton, published in 1886. Two widows, one with a son in business in Japan, decide to see the world and set out for the Orient. On the way they are shipwrecked but escape in a leaky boat which, however, finally sinks under them. They make their way to a small coral island with their companion, Mr. Craig, who tells the story. On the island they take possession of the summer place of the Dusantes and make themselves at home. Ruth Edgerton, a missionary's daughter, and her father then join the party. The two old ladies decide, among other things, that Mr. Craig should marry Miss Edgerton, and in their own inimitable way they accomplish their end. Before leaving the island, they write a note to the owners of the house where they temporarily stayed. In *The Dusantes* (1888), a continuation of the tale, the widows and the Dusantes meet back in the states under exciting circumstances.

Representative of Stockton's unique method of storytelling, these absurd tales are told in a gracefully realistic manner.

CASTLE, kàs"l, Egerton, English novelist: b. London, England, March 12, 1858; d. there, Sept. 20, 1920. He was educated in Paris, Glasgow, and at Cambridge. After a brief military career he turned to journalism, and was publisher of the *Liverpool Mercury*. From 1885 to 1894 he served on the staff of the *Saturday Review*. Among his numerous works are *Consequences*, a novel (1891), *Saviolo*, a play (1893, co-author W. H. Pollock), *Young April*, a romance (1899), *The Star-Dreamer* (1903), *Panther's Cub* (1910), *Wolf Lure* (1917), and *New Wine* (1919). A great number of his novels were written jointly with his wife, Agnes Sweetman Castle (d. 1922), including *The Pride of Jennico* (1898; later dramatized) and *The Bath Comedy* (1899; dramatized as *Sweet Kitty Bellairs*).

CASTLE, Vernon (originally VERNON BLYTHE), English aviator and dancer: b. Norwich, England, May 2, 1887; d. Fort Worth, Texas, Feb. 15, 1918. He was educated for civil engineering at Birmingham University. In 1906 he came to the United States and the following year made his theatrical debut in *The Girl Behind the Counter*. His outstanding talent, however, was dancing; he originated the one-step, turkey-trot, and Castlewalk. After his marriage in 1911 to Irene Foote of New Rochelle, N. Y., he opened a dancing school and devoted himself entirely to exhibitions and teaching; he became very popular in Paris in 1912. In 1915 he took up aviation, received his pilot's certificate in the United States, and in February 1916 enlisted in the Royal Flying Corps. He served in France and during the next year made about 200 missions over enemy lines. In 1918 he was transferred to Fort Worth, Texas, as an instructor but was killed in a collision with a cadet. He was known not only for his dancing but won the respect of military officers for his spectacular flying.

CASTLE, William Ernest, American zoologist: b. Alexandria, Ohio, Oct. 25, 1867. He studied at Denison University and in 1894 received his Ph.D. from Harvard. After serving in various teaching capacities at Ottawa (Kans.) University, University of Wisconsin, and Knox College, he became assistant professor of zoology at Harvard in 1903, being promoted to a professorship, 1908-1936. He wrote numerous articles on embryology, animal morphology, and heredity; his books include *Heredity in Relation to Evolution and Animal Breeding* (1911), *Genetics and Eugenics* (1912), *Genetics of Domestic Rabbits* (1930), and *Mammalian Genetics* (1940).

CASTLE. See CASTLES AND CHÂTEAUX.

CASTLE CLINTON (at one time CASTLE GARDEN and later the NEW YORK CITY AQUARIUM), originally a small, partially submerged, rocky island known as Capske (Copsie, or Copsy), about 200 feet off the shore of the Battery, at the southwestern tip of New York City. In November 1807 the island was given by the city to the federal government for the construction of a fort, completed in 1811 and called West Battery. One of the city's main defenses in the War of 1812, West Battery and Fort Jay on Governors

Island guarded the entrance to the East River. At the war's close in 1815, West Battery was renamed Castle Clinton in honor of DeWitt Clinton, mayor of the city. By an act of Congress, at the end of March 1822, it was ceded back to the city. During its entire history, not one shot had ever been fired at the enemy.

On June 12, 1824, it was leased as an amusement place and opened the following July 3 as Castle Garden. The building, now with a roof added, was used as a reception place, theater, music hall and opera house, and in the 1840's and early 1850's housed numerous exhibitions and fairs. Lafayette was given a reception there in 1824; Jenny Lind, sponsored by P. T. Barnum, made her American debut there on Sept. 11, 1850; and Samuel Morse, in 1835, presented one of the earliest demonstrations of the telegraph. Other notables to have visited Castle Garden were Andrew Jackson, 1832, John Tyler, 1843, and the Hungarian patriot Lajos Kossuth, 1851. In 1855 it became a landing depot for immigrants and on August 3 of that year received its first group of aliens. It remained as an immigration center until 1890 when the federal government moved the station to Ellis Island.

In 1848 the city decided to enlarge Battery Park by extending the mainland, and by 1869 enough land fill had been added to surround Castle Garden on three sides. In 1896 the building was opened as an aquarium which was taken over by the New York Zoological Society in 1902. The aquarium was moved in 1941 to the Bronx Zoo but will be housed in a new building at Coney Island, planned to open about 1955. The original fort, Castle Clinton, was established as a national monument on Aug. 12, 1946, and is being restored; it is under the jurisdiction of the National Park Service. See also AQUARIUM.

CASTLE GARDEN. See CASTLE CLINTON.

CASTLE HILL, hill near Benedictine monastery at Cassino, Italy, which was captured by Indian troops, March 15-20, 1944, after bitter fighting in World War II.

CASTLE OF OTRANTO, The, a novel by Horace Walpole, published in 1764. It owes its importance to the fact that it was the first example of the so-called Gothic romance, a type of fiction which, in the hands of writers like Anne Radcliffe, became highly popular in the late 18th century as a reaction against the sentimental and realistic novels of the school of Richardson; it also prepared the way for the great exploitation of medieval romance in the historical novels of Sir Walter Scott. Intrinsically, *The Castle of Otranto* is interesting chiefly by virtue of its absurdity. The scene is a medieval castle with battlements, trapdoors, and intricate subterranean cloisters; the theme, the mysteries which it harbors within its walls. The plot, involving a gloomy tyrant, a persecuted wife, a lovely young prince, and two romantic girls, employs the supernatural at every turn, such as a gigantic helmet crashing from heaven into a courtyard, or an ancestral portrait stepping forth from its frame and becoming a ghost. These strange matters cause many difficulties for the chief characters but in the end lead to a somber yet satisfactory ending. Walpole based his novel upon his little pseudo-Gothic house at Strawberry Hill, near London, a house which was famous in his time

for its break with the strong neoclassical principles then in vogue.

CASTLE PINCKNEY, national monument. See NATIONAL PARKS AND MONUMENTS.

CASTLE RACKRENT, a novel by Maria Edgeworth, written in 1801. Although it was her first novel, it is still regarded by many critics as her masterpiece. It belongs to that series of novels dealing with Irish life, which elicited the praise of Sir Walter Scott and other contemporaries. The opportunity which Miss Edgeworth had of studying Irish conditions at first hand enabled her in these novels to draw a powerful and substantially accurate picture of contemporary conditions in Ireland. The theme of *Castle Rackrent* is the wasting fortunes and the final disaster of an honorable Irish family as the result of carelessness, improvidence, folly, and absenteeism. The story, of only a few score pages, is told by a faithful old retainer of the family, Thady Quirk, who lives through the successive reigns of Sir Patrick, who drank himself to death; of Sir Murtagh, the close-fisted, who wasted his substance in lawsuits; of the dashing Sir Kit, an absentee landlord, who married a Jewess whom he confined for seven years in her chamber, and who met his death in a duel; and finally of Sir Condy, under whose easy ways the estate finally passed from the hands of the Rackrents into those of creditors, particularly Jason Quirk, the son of old Thady, who bought the debts of the property. The story is told in a vigorous manner, full of local touches of a lively character.

CASTLE SHANNON, kás'í shán'ün, borough, Pennsylvania, in Allegheny County; altitude 820 feet; 6 miles south of Pittsburgh; on the Pittsburgh and West Virginia and the Pittsburgh railways. It is a residential community governed by a borough council and a burgess. Founded in 1782, it was incorporated in 1918. Pop. (1950) 5,459.

CASTLEBAR, kás'í-l-bär', urban district, Ireland, capital of County Mayo; 140 miles northwest of Dublin; on the Castlebar River. It is situated in a cattle-raising and potato-growing region. The town was founded by Sir John Bingham and received its charter in 1613. In 1641 the Parliamentary forces under Sir Henry Bingham surrendered to the Irish Confederates under the earl of Mayo but later were massacred at Shrule Bridge by Edmund Bourke, a clansman of the earl. Nearby is the site of the battle known as "Castlebar Races" in which the French general, Jean Robert Marie Humbert, defeated Gen. Gerald Lake in 1798. Pop. (1946) 4,951.

CASTLEFORD, kás'í-l-fërd, urban district, England, in West Riding, Yorkshire, on the Aire River; 10 miles southeast of Leeds. It is in a coal mining region, and bottles, pottery, machinery, and chemicals are manufactured. Pop. (1951) 43,116.

CASTLEMAINE, kás'í-l-mān, town, Australia, in the State of Victoria; 65 miles northwest of Melbourne. It owes its importance to the mining industry carried on in the neighborhood, the most important products of its mines being gold, flagstone, and slate. Its goldmines

are famous as being among the original ones discovered in Australia. Pop. (1947) 5,809.

CASTLEREAGH, VISCOUNT. See STEWART, ROBERT.

CASTLES AND CHATEAUX. The English word castle is derived from the Latin *castrum*, itself a diminutive of *castrum*, a fort. Thus, from its origin, it involved the concept of defensibility. However, in the Vulgate, *castrum* refers to villages whose buildings were fortified. Hence a castle is essentially a defensible home. The French word *château*, with the same root, has come even more to mean a house, usually a large country house.

The Ancient Castle.—Little need be said about fortifications in Egypt. Early in its history, the royal palaces were fortified with towers and parapets, and that tradition lingered on in the homes of the ruling class perhaps after its real military reason had gone. With the expansion of Egypt up the Nile in the 12th dynasty, there was real need for defense on the southern frontier. There the fort of Semna was built with heavy brick walls reinforced by bonding members of timber and by massive buttresses.

The ruling caste in Assyria, renowned in literature for its ferocity, was in constant danger both of internal unrest and of attack from without. Hence thick walls of mud brick bounded such cities as Khorsabad; paired towers flanked the

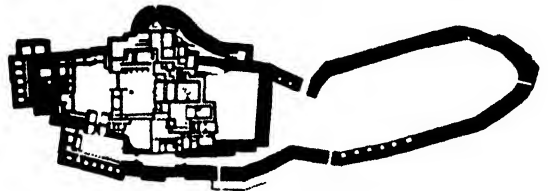


Fig. 1. Citadel, Tiryns.

city gates, with other battlemented towers at intervals along the wall. From these walls and towers in case of attack, the Assyrian archers could discharge their arrows in comparative safety. At one point the city wall was widened into a platform for the palace of Sargon II (722-705 B.C.) which thus became a bastion to protect Khorsabad. Chariots could drive up ramps to the broad top of the wall and into the courts of the one story palace. The gates to the palace, its walls, and even its courts were also provided at intervals with battlemented towers. The palace was arranged around several courts, the men's or royal court with its suite of state apartments, a servants' court or khan, presumably a women's court or harem, and finally an area for religious purposes with its pyramidal tower or ziggurat built up in seven stages. Guardian monsters carved in stone with the legs and body of a lion—or sometimes a bull, the wings of an eagle, and the head of a man flanked the main entrance. Friezes sculptured in low relief in the royal apartments commemorated the king's prowess in warfare or in the hunt. Rugs covered the floors, and no doubt textiles helped to create a sumptuous atmosphere.

The Greek chieftains of the Mycenaean period likewise fortified their palaces. The citadel at Tiryns (Fig. 1), built toward the end of the second millennium B.C., has walls 26 feet thick that approximately follow the contours of its hilltop. These walls are built of "Cyclopean" masonry;

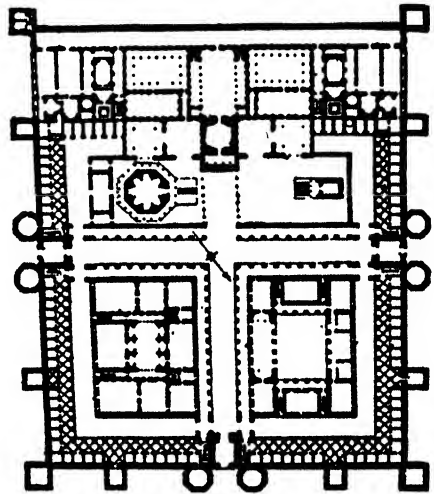
that is, large blocks of stone of irregular shape fitted together. Narrow passagelike chambers covered by corbel vaults penetrate part of the wall from within and probably served as storage space for provisions and weapons. The chariot entrance led up a ramp so arranged that the fortress wall was on the right of the chariot. Since the Greek warrior carried his shield on his left arm and his spear or sword in his right hand, this meant that, during his approach to the gate, his right or unprotected side was exposed. If an attacking party succeeded in forcing the first gate, they found themselves in a narrow alley flanked on both sides by strong walls and with secondary gates at either end, one on the right leading to the lower ward or bailey, the other to the palace area. Still another wall divided the palace from the bailey so that even if the latter were captured, the task of the attackers was by no means over. Narrow postern gates, too small and their approaches too steep for chariots, gave secondary access to the lower ward and to the palace proper. If, however, a peaceful visitor arrived, he might drive his chariot through the gates, through the outer court separated by an entrance pavilion or propylaea from the middle court where he could leave his steeds to enter through a second propylaea into the inner court in front of the men's suite or megaron with its open hearth. This was the center of life in the palace; around it were grouped the quarters for sleeping and other activities of life, and although there was a secondary court and suite of rooms for the womenfolk, the thalamus, approached from the megaron by circuitous routes, nevertheless men and women mingled in the megaron in ordinary daily life. While waiting for Odysseus' return, Penelope worked her embroidery and entertained her suitors here, but retired at night with her maidens into the thalamus.

The Acropolis in Athens, a civic and religious center in historic times, offered great natural facilities for defense; its abrupt slopes, where necessary, were further reinforced by walls. As Athens grew, however, Themistocles walled in the city, about 480 B.C. Rome likewise was defended by walls, parts of which still survive. The old republican wall was outgrown before the empire, but extensive later walls were added, as for example by the Emperor Aurelian, begun 271 A.D.

During the centuries of the *pax romanum*, except near the frontiers, no reason existed to confuse domestic architecture with provision for defense. Though still almost a century would elapse before the first serious incursion of the barbarians through the Rhenish-Danubian frontier, it is almost symbolic that Diocletian in the late 3d century should build his palace at Spalato in what is now Yugoslavia. At least the location brought him closer to the frontier than Rome. Moreover, the plan of his palace (Fig. 2) was influenced by the Roman military camp. The latter was laid out foursquare, its gates in the center of each side with straight roads connecting them and dividing the camp into quarters. Likewise a square wall enclosed Diocletian's palace, and streets bisected it in both directions. Three of the walls were defended by towers at the corners, in pairs around the gates, and at mid-points between the corners and the gates. The fourth wall built on the very shore of the Adriatic needed no defense; it could provide an

open gallery along its length as a promenade. This lack of fortification on the sea front again is suggestive; though Diocletian may not have anticipated an actual assault, it was clear that if one should occur, it would come by land, not by sea. The tribes along the Danubian frontier were landmen.

The Medieval Castle.—The heyday of the castle as an architectural form in western Europe was the Middle Ages from 1000–1500. For this the feudal system was responsible. The weakness of the royal power permitted the nobility to become nearly independent in fact if not in theory. The system allowed, if it did not actually encourage, the nobility to prey when possible on their neighbors or on the surrounding countryside; therefore, they were compelled to make their own homes as nearly impregnable as might be. Since these conditions existed over most of Europe with some local variations, it follows that the basic ideas of the castle existed alike in France and Germany, in Spain and England, and



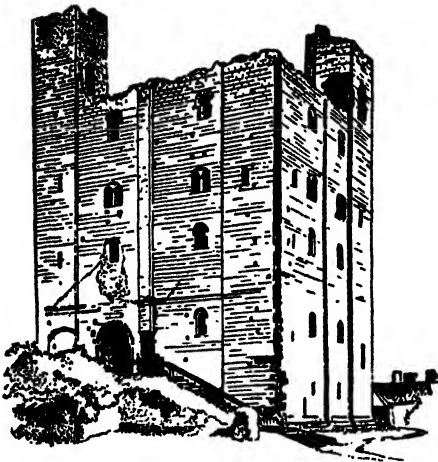
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FIG. 2. Palace of Diocletian, Spalato.

that the variations from country to country are less marked than the similarities.

Although after the Norman Conquest of 1066 the royal power in England was generally stronger than it was on the Continent, the Norman feudal barons required strongholds to control the land and the conquered Saxons. One such, of great historical interest, is the Tower of London begun in 1078 by William the Conqueror. Though complicated by extensive later additions, the White Tower was the nucleus, the keep, so-called because the lord and his garrison lived or kept there. Several stories high with double walls, small windows, and spiral stairs in the corners of the tower, it was quite typical of its day. Perhaps the most interesting feature is the Chapel of St. John, a characteristic small Romanesque church. Such chapels were customary in the larger castles not only to serve the religious needs of the household, but doubtless also were used by the lord of the castle for private conferences since the hall would rarely be empty of retainers.

Hedingham Castle (Fig. 3), Essex, built about 1130, the home of the de Veres, was one of the



Courtesy Country Life, Ltd., London.
Fig. 3. Hedingham Castle.

most perfect of the Norman keeps until it was gutted by fire during World War I. Solidly built with double walls of stone 20 feet thick, its corners were still further reinforced. A flight of steps, arranged like the ramp at Tiryns to expose the unshielded side of an attacker, led up to the door at the level of the second floor. This door entered the great two-storied hall, the center of life for the garrison. Aside from small areas within the thickness of the walls where the meager sanitary facilities of the castle were located, this hall was the interior. Within it the family and its retainers ate, slept, and had their being. Such light as there was came from the few small windows high up in the wall and utterly inadequate by modern standards, but necessarily kept to a minimum not only for defense but for warmth. Since window glass was not available, any warmth on the interior could be preserved only by closing the windows with shutters which excluded even the little light these openings might afford. For heating, a fireplace was built in the center of one side of the hall, its chimney rising in one of the middle buttresses of the outer walls. The ceiling of the hall was carried on a single great arch that spanned the hall from side to side. The familiar round arch of the Romanesque style and its characteristic moldings adorn fireplace, door, windows, and indeed wherever architectural emphasis was required. Above the hall was another chamber of the same size, also warmed by a fireplace. Probably the womenfolk of the household carried on their activities here, and it may also have served as private quarters for the de Veres. Access to it as well as to the ground floor was provided by spiral stairs in one corner of the keep. Since there was no other entrance to the ground floor it could have served as a dungeon for prisoners but was probably used mostly for storage purposes. If the space provided for the varied purposes of living in Hedingham Castle seems restricted, it was clearly because the necessity for defense superseded comfort. Still Hedingham was not quite so confined as this description implies; wooden structures that could be destroyed if a siege were imminent once covered the door and the stairway. Traces of the roofs where they joined the masonry of the keep are still visible.

One of the largest of the Norman keeps was Colchester Castle, Essex, of the late 11th century,

measuring 152 by 111 feet exclusive of the towers, so large in fact that walls subdivided the interior. The upper stories at Colchester have been destroyed, but the keep at Rochester, Kent, rises to a height of more than 100 feet. It was begun by Archbishop William of Corbeil (d. 1136). Somewhat later, perhaps built about 1150, is the small but delightful Castle Rising, Norfolk. In addition to the exceptional richness of its arcades and moldings, we have here an example of a fore building designed to enclose the stair. The door at the ground level gave access to the stairs that led up along the wall of the castle to the main door at the second story.

Perhaps the desire for ampler accommodations contributed to the development of the courtyard castle whose towered and battlemented walls enclosed a more or less extensive bailey or perhaps more than one. Thus in the early 13th century at Pembroke Castle in South Wales, the walls encircling the outer and inner bailies followed the contours of the hilltop with towers at each change of direction. Within the bailey, its entrance guarded by a heavily fortified gatehouse,



Fig. 4. Coucy-le-Château.

was ample room not only for living quarters but for livestock. The concept of the keep was not abandoned, however; it was merely built either within the bailey, as at Pembroke, or in Coucy-le-Château in France as the strongest point in the castle walls. Moreover, the square plan of the Norman keep was changed to a circular tower as were the other towers of the outer walls. This change probably results from the Crusades which brought western Europe into contact with such Byzantine round towers as Rumeli Hisar near Constantinople, built about 1100 by Alexius Comnenus. These Byzantine forts had already influenced the Saracens in their fortifications of Antioch, Nicaea, and Jerusalem that offered such formidable resistance to the crusaders.

Though not large, Coucy-le-Château (Fig. 4) of the early 13th century was an excellent example of the early Gothic castle. Walls whose angles were reinforced with round towers surrounded the irregular court and permitted the living quarters of the garrison to be built within and against the walls. Timber galleries might be added atop these walls and projecting from

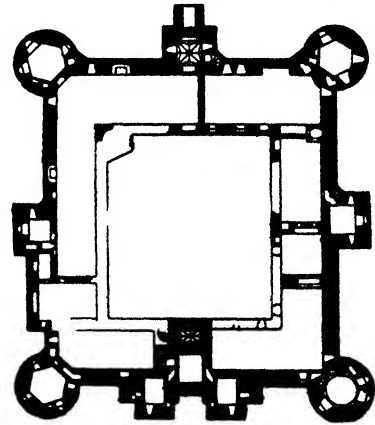
their faces to permit the discharge of missiles on the heads of an attacking party. The keep or dungeon, 210 feet high, was the strongest feature and the point of last resort for the garrison if the bailey should be forced. Actually such castles were rarely taken except by treachery. Coucy never was, and its strength justified the arrogant motto of its lords: "I am not a king, nor a prince, nor a duke, nor even a count; I am the lord of Coucy."

Obviously if the homes of the nobility required such provision for defense, town dwellers also needed protection. Hence arose the walled city. If laid out afresh, and if built on level ground, the defenses were as regular as those of a Roman camp. Thus at Aigues-Mortes in Provence built by St. Louis in the 13th century, square walls with towers at regular intervals defended the town. The gates, also protected by towers, were in the center of each side. Indeed the only element of asymmetry, but a significant one, was the keep placed at one corner of the city walls. A larger and more famous example dating from several centuries is the city of Carcassonne. Here the terrain dictated irregularity in the walls which march up and down the slopes. The Middle Ages though not hostile to symmetry were always willing to abandon it when some requirement of either the site or the building suggested such a departure. The village of Villeneuve-lès-Avignon shows another, though less well-preserved, example. Parts of these old city walls are preserved in many places. Perhaps the best-known English example is Chester where quite an extensive walk on the walls is still possible.

In the second half of the 13th century, Edward I built a series of castles, many of them designed to hold in check the turbulence of the Welsh marches. Caerphilly Castle (1267-1277) in Glamorganshire, one of the earliest built in the Edwardian style, shows the new method of designing the castle with double walls—the inner ones enclosing the inner court or bailey, the second wall completely enveloping the first with space for an outer bailey between them. More than one gate made the task of investment by an enemy more difficult, and the presence of additional outworks still further hindered the attackers. Curtain walls punctuated with round towers suggested a derivation from Saracenic fortifications in Palestine. Conway Castle (1285-1287) in North Wales is another excellent example; long and narrow, its walls follow the contours of a high rock on the shore of the Conway River. Caernarvon Castle (1285-1322) with its hourglass form is on relatively level ground; but the double, or in part even triple, walls of Harlech Castle (1285-1290), Merionethshire, provide for outer, middle, and inner bailies. Naturally the strongest defenses of these castles were concentrated at their weakest points.

Complex as these large royal castles are, they do not provide the clearest illustrations either of what might be required normally for defense or still more of provision for the living requirements of the family and its household. For these purposes it is preferable to examine the small but very picturesque Bodiam Castle. In 1386 a license was granted to Sir Edward Dalyngrigge "that he may strengthen with a wall of stone and lime and crenellate and may construct and make into a castle his manor house of Bodiam, near the sea, in the county of Sussex, for the defense of

the adjacent country and the resistance of our enemies." This rectangular form of castle (Fig. 5) with its omission of the concentric walls of Edwardian castles came into vogue during the Hundred Years' War between France and England. A moat girdled the castle. The principal approach led over a wooden causeway from the side of the moat to a stone outwork, the barbican. A second bridge led in turn from the barbican to the main gate. In case of attack, these bridges, heavy enough for equestrian traffic, could be destroyed in succession; the second bridge would be demolished only if the barbican were captured or for any reason had to be abandoned. A small bridge for pedestrian traffic only crossed the moat to the postern gate at the back of the castle. Round towers defended the corners of Bodiam while square towers, paired around the main gate, marked the center of each side. Small windows, hardly more than loopholes, were strategically placed in the towers so that fire from them could be brought to bear either on the enemy across the moat, or along the walls if the attackers were bold enough to force their way across the water to the base of the wall. In fact the only window of any considerable size



Courtesy Jonathan Cape Ltd., London.

FIG. 5. Bodiam Castle.

was the chapel window, high enough in the wall to be secure. The lower few feet of the walls were battered; that is, designed to slope outward. The purpose of this batter was less structural than military; if the base of the castle were approached, missiles dropped by the defenders from the top of the wall would be deflected outward by the batter against an attacking party.

Naturally the strongest defenses were reserved for the main gate. Here the towers were not only crenellated (battlemented); they were machicolated. The parapet was advanced beyond the plane of the wall on brackets, between which were openings to permit stones or perhaps boiling water to be dropped on the heads of an assaulting party. The notion of pouring molten lead on the enemy was more picturesque than practical in view of the value of metal in the Middle Ages. Loopholes or narrow slits would permit archers or crossbowmen to fire from comparative safety within. The last few feet of the causeway were made into a drawbridge that could be raised at night or when otherwise desirable. Finally a heavy timber grille or portcullis, reinforced with iron, slid down in front of the door, held in place by solid masonry on both sides.

Before the days of gunpowder, such a castle as Bodiam was practically impregnable, if the garrison remained loyal. To besiege such a castle involved keeping an army of sufficient strength in the field long enough to starve the defenders into submission. Since these castles were well provisioned and had their own sources of water within the walls—the kitchen tower at Bodiam had an ample well—a siege could be undertaken only at great cost. Arrows and crossbows would of course have no effect on these masonry walls, but the walls could be undermined. The presence of the moat, however, made that difficult and also hindered the approach up to the walls of movable towers from whose tops an attacking party might force an entrance. Battering rams and catapults that discharged heavy stones might in time batter down such walls, or incendiary arrows might ignite any inflammable materials within the castle; but since most of the interior, like the walls, was made of stone, the possibility of capture by assault was small indeed.

A welcome visitor, on the other hand, might ride across the bridges and through the barbican and the main gate. He would then find himself in the court, lined with rooms for the family and the household. To his left were the private chambers of the family including the castle chapel, small but adequate to the needs of the establishment. To his right and behind him were retainers' quarters and no doubt storage areas. Directly ahead he would see the door to a passage which in turn led to the postern; to the left was the great hall of the castle with the solar or withdrawing room of the lord and the ladies' bower at its further end; and to the right, an entrance to the pantry, the buttery, and the kitchen. These arrangements were almost standard in the later Middle Ages.

Though still the largest single room in the castle, the hall has dwindled in size relative to the space provided for other purposes when compared, for example, to the hall at Hedingham Castle. This smaller size reflected the change in living. No longer was it common to sleep in the hall; bedrooms were provided both for the family and the household. Although still used for meals, the custom of the family eating with the retainers was fading. Two quotations indicate the change. In 1235, Robert Grosseteste, bishop of Lincoln, wrote, "As much as ye may, eat ye in the hall afore your many (household) for that shall be to your profit and worship." But by the 1360's, Piers Plowman could say, "Dull is the hall each day in the week where neither lord nor lady likes to sit. Now has every kingdom a rule requiring one to eat by himself in a private parlor or in a chamber with a fireplace and to avoid the great hall that was made for men to eat in." Piers was kind enough to indicate a probable reason for the change. Although the hall usually had its fireplace, or a fire might be kindled in the center of its stone floor, its large size could not but have left it chilly and drafty. Nor could the rough retainers have been suitable companions at all times for the gentler members of the household. On the other hand, the courtyard solved the problem of adequate lighting for the hall and incidentally for the other rooms of the castle. If the outer wall for defensive reasons could have only a few small windows like those in Hedingham Castle, large windows could open into the court. Glass, how-

ever, remained a rare luxury until the 15th century or even later, and although oiled paper may have shut out some of the drafts, shutters were still the basic way of closing windows.

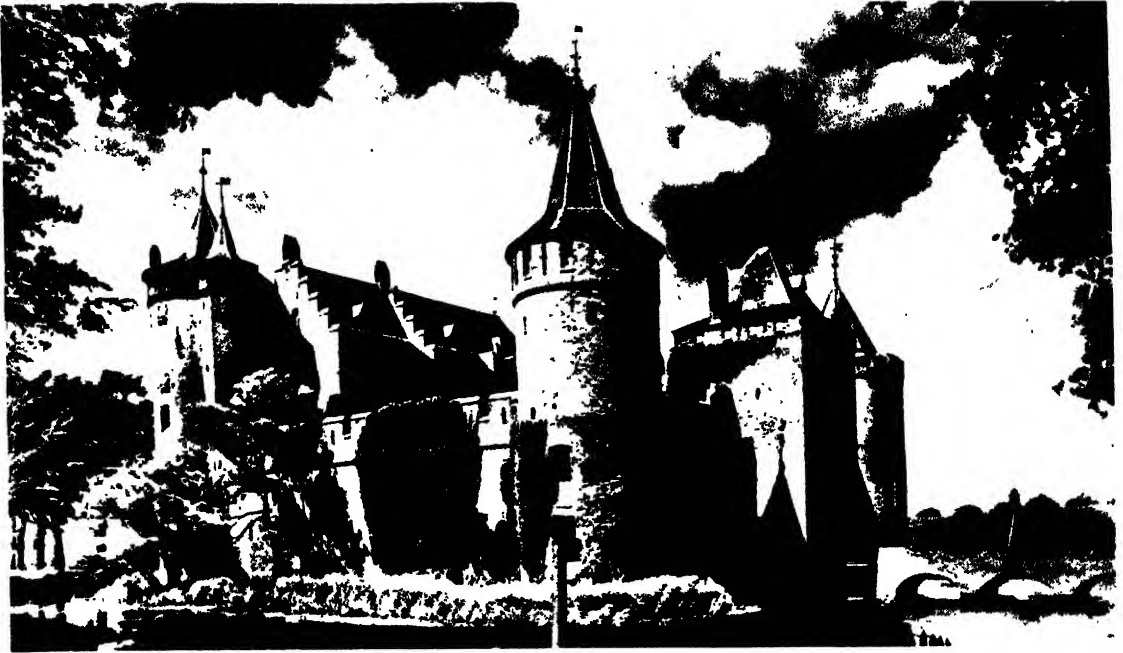
Next to the hall, the kitchen would be the largest room with its fireplaces perhaps capable of roasting an ox. Space was essential here in view of the number of mouths to be fed. In addition to the family, the household with its servants, its retainers, and its men-at-arms had to be provided for. Since Bodiam Castle required twenty garderobes (toilets), we may safely envision a household of very considerable numbers. These castles or manors also needed extensive storage space for provisions and activities through the year.

Many of the larger and more famous castles result from centuries of building and rebuilding. The royal castle at Windsor, for example, was begun by Edward III to replace an older castle which in part dated back to the time of William the Conqueror but has been much added to later. Kenilworth Castle, Warwickshire, celebrated by Sir Walter Scott, was begun about 1120; it later passed into royal hands, was given by Queen Elizabeth to her favorite, the earl of Leicester, and was subsequently destroyed in part under the Commonwealth for the sake of its building materials. One of the most imposing of them all was Warwick Castle, begun shortly after the Norman Conquest. Probably the most celebrated Irish castle is Blarney, now in ruins but still visited for sentimental reasons. In Scotland, Edinburgh Castle dominates the city; it was once a palace for the kings of Scotland.

The elements of military architecture in the Middle Ages and the life led within the castles did not differ essentially on the Continent from that in England. Thus the Château de Pierrefonds (1390-1400) was girdled first by a moat. Its approximately rectangular curtain wall linked together round towers at the corners, and in the middle of each wall, that serving as the entrance being larger and stronger than the others. The lower part of the walls was battered and their tops provided with machicolated parapets. Quarters for the garrison and retainers lined the courtyard as they had at Bodiam, although the owner, as befitted so high a noble as the duke of Valois, had a nearly independent residence near the gatehouse. Pierrefonds was dismantled in 1617 but restored during the 19th century by Viollet-le-Duc. The ruins of the Château Gailard, near Les Andelys, built by Richard Coeur de Lion are interesting historically. Though also in ruins, the Château de Gisors, its circular keep dating from about 1160, displays an early type. The keep was large enough to contain a chapel and was set within a broad bailey defended by a curtain wall with towers at intervals and with its principal gate heavily defended behind a barbican.

Owing partly to the weakness of the Holy Roman Empire during the later Middle Ages, the decentralization of feudalism was more pronounced in Germany than elsewhere. In consequence many castles were built by the robber barons of Germany to protect their lands or to levy tolls along the waterways and highways. Those along the Rhine from Bingen to Coblenz in particular are picturesque to a degree as they take advantage of the hilly ground. For example, Drachenfels, near Königswinter, was begun by Arnold, archbishop of Cologne, in 1147, and has

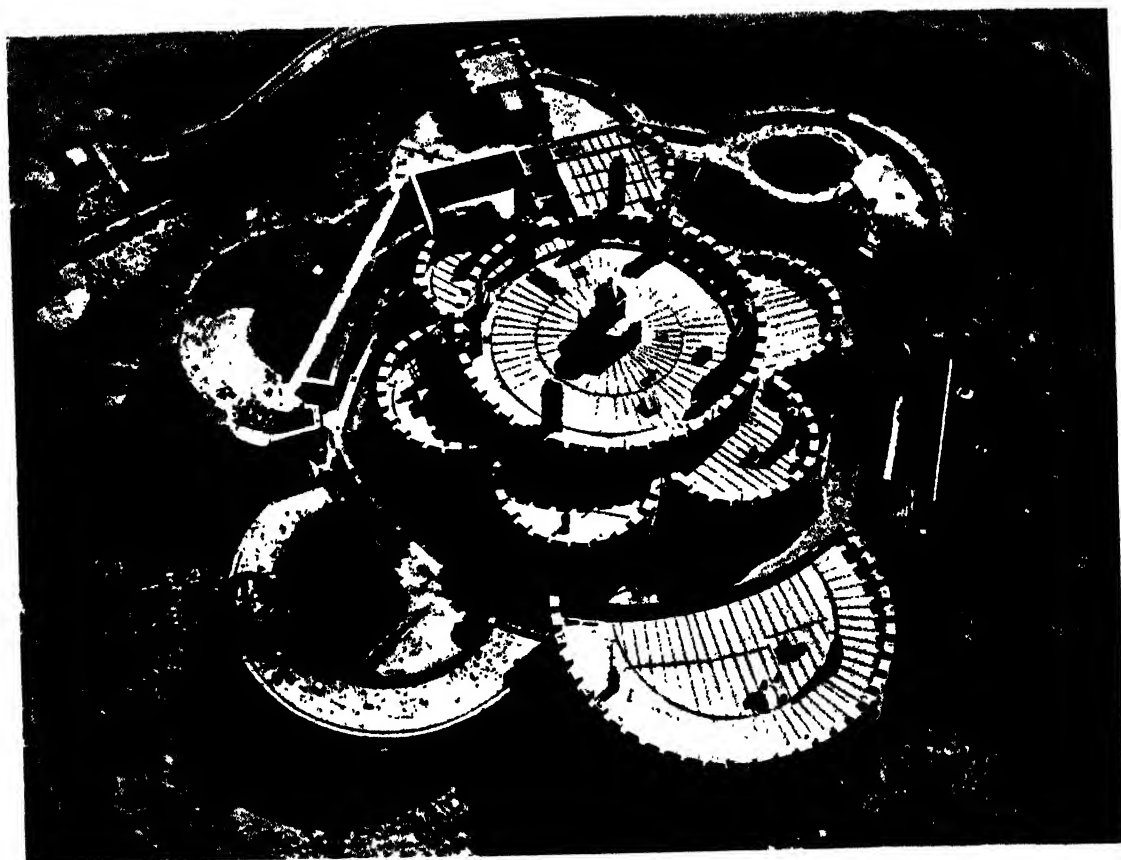
CASTLES



Top: Castle of Muiden in the Netherlands, dating from the 13th century, famous in Netherlands history. Center: The impressive 440-room Chateau de Chambord, department of Loir-et-Cher, France. Bottom: The Chateau of Aigle in the Rhone Valley, Switzerland, is situated in a vineyard region.

Netherlands Information Bureau; French Embassy-Information Division; Swiss National Travel Office

CASTLES



Above: Aerial view of Deal Castle, England, showing the six stone bastions and round, central tower built by Henry VIII
Left: Kenilworth Castle, Warwickshire, England, for centuries a stronghold of the realm. Bottom: Braunsfels Castle in the Hesse region of Germany.

British Information Services, and German Tourist Information Office



been much added to later. The 12th century castle of Schönburg with its four towers, near Oberwesel, is connected by legend with the Lorelei, while still another is Ehrenbreitstein where the Moselle joins the Rhine. Though many of these castles still exist, almost all have been drastically modified later.

The Moorish conquest of Spain and the centuries-long effort of the Christians to free the country brought into being a wealth of castles in the Iberian Peninsula. The place of religion in that war is suggested in the 11th century walled city of Avila with its 86 towers, where the fortresslike apse of the cathedral of later date forms a bastion. The mid-15th century Castillo de Fuensaldaña has a rectangular bailey with a great tower on one side capable of independent defense. The long struggle with the Moors left its mark on many Spanish castles as, for example, on the late 15th century Coca Castle where the Moorish influence is particularly strong. Architecturally, Coca with its immense batter of its lower walls, its multiple circular and polygonal towers and turrets, and its decorative band of brickwork around the top of its walls is magnificent, but Coca was so flimsy in construction as to give more the appearance than the reality of military strength. The Alcazar, Segovia, especially on the interior was also Moorish in style, while its tall and slender turrets at the angles, like minarets, make of it a picturesque "castle in Spain," though in fact the old fortress was destroyed in the 19th century and the present structure is purely modern.

The Renaissance Châteaux.—The medieval castle was almost immune to the weapons and methods of attack of its time. Although gunpowder was known in Europe at least as early as the 14th century, the changes it wrought in fortifications became evident only in the early 16th century. Under its impact, stone walls and towers lost much of their value. Moreover, with the growth of royal power, the intermittent warfare of feudalism disappeared so that defensibility was no longer essential to houses. Even so the influence of the castle was destined to linger on for centuries in French building.

The Italian Renaissance involved greater comfort, even luxury, in living than had existed under the feudal culture of the Middle Ages. Such virtual innovations as chairs, some of them upholstered, and forks as a normal item of tableware point to the growing sophistication of life. Up to the end of the 15th century, the peoples of northern Europe, including the French, remained unaware of these cultural changes. However, in 1494, Charles VIII undertook a military expedition into Italy in a futile attempt to establish his claim to the kingdom of Naples. Though unsuccessful, his venture introduced the culture of Italy to the French aristocracy; it was followed by the Italian invasions of Louis XII, and still later of Francis I. Thus French royalty and nobility were stimulated to try to transplant to France the forms of the Italian Renaissance. For this purpose, they invited Italian artists to Paris and Fontainebleau, and the designs of their châteaux begin to show Italianate elements.

The change could not take place over night. The Louis XII wing (1503) of the Château of Blois, though unfortified, remained predominantly Gothic. Its steep pitched roofs, its window forms, its traceried parapet at the top of the wall bespeak the force of medieval tradition, the

habits of design ingrained for centuries in the French builders. But around the doorway a few details of carving betray an awareness of Italian forms. Though only a few years later, the Francis I wing (1515–1519) at Blois had traveled further along this road. The Italianisms consist essentially of decorative shapes substituted for Gothic details, with but little change in the larger elements of design. Thus instead of Gothic pinnacles and a simple gable over the dormer windows, the new designers preferred candelabralike shapes and a tabernacle. In place of the Gothic tracery in the parapet, they used heraldic devices and the moldings of a classic cornice. Superposed pilasters created the vertical divisions of the wall. Canopied figures and Italian arabesques adorn the buttresslike supports of the spiral staircase, but the canopies like the dormers have been converted to the new forms. Significantly these rich Italianisms derive not from the serious examples of Renaissance architecture in Florence, but rather from the exuberant detail of such Lombard buildings as the façade of the Certosa at Pavia. Inevitably the French first encountered the north Italian style when they came down over the Alps into the plains of Lombardy, and it was the sumptuousness of this style that first impressed them. Aside from these Italian details, the major building forms continue from the French past. The steep pitched roof, the vertical divisions of the walls, the shape of the windows, and the towerlike projection of the stairway have lingered on. The spiral stairs of the medieval castle were placed in turrets that kept the stairs half inside and half outside the building. However, the stairs are larger here, and the lack of fortifications enables them to be open. So, too, the windows in the outer walls are larger. By this time, glass for windows had become common so that light could be provided without sacrificing warmth.

The Château of Chambord (1519–1538), being a more unified design, obviously shows the persistence in plan of French tradition even though its architect may have been the Italian Domenico Bernabei of Cortona, nicknamed Il Boccadoro. (Fig. 6). Aside from the Italian details carried out with a certain Rabelaisian exuberance, the new influence is apparent in the symmetry of the building. The Renaissance laid greater emphasis on symmetry than had the Gothic even to the extent at times of arranging the windows and doors to balance regardless of the interior, and perhaps of ignoring in their design irregularities of the site, although the latter was not a factor at Chambord.

But if these things point to the Renaissance, others perpetuate the traditions of the castle. The rectangular plan enclosed a court reminiscent of the castle inner baillies. The main unit

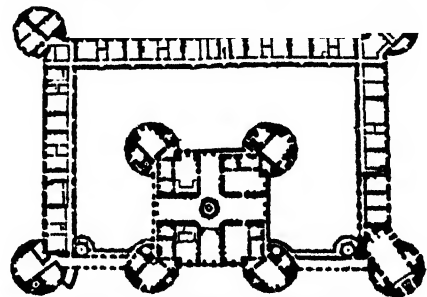


FIG. 6. Château of Chambord.

at Chambord in the center of the front projects into the court and corresponds to the medieval keep. This part, to be sure, has intersecting axial halls centering on the great spiral staircase now wholly inside of the building, but the long wings that enclose the court are still only one room and a corridor in width and in that are similar to the arrangement at Bodiam within its curtain walls. Towers linked together by other blocks of building compose the façade of Chambord. The derivation from the angle and intermediate towers and curtain walls of the medieval castle is obvious; in design both create an alternation of vertical and horizontal units, of strong accents set off by less emphasized portions. Such accents are almost never to be found among the Renaissance palaces of Italy. That these towers and links were conceived as semi-independent units is apparent in the arrangement of the visible roofs; conical roofs supporting turrets cover the towers while each link has its own gable roof hipped at both ends.

Like the exteriors, the interiors of the important rooms in the châteaux of the early 16th century combine medieval forms and Renaissance decoration. Thus the beams and joists that support the floors above are left visible to form the ceiling of the room below instead of being concealed by plaster or decorative paneling. The large fireplaces are still hooded, but the hood invited and received adornment in the form of Italian arabesques, heraldry, or cartouches.

During the reign of Francis I and his successor Henry II, many châteaux were built or rebuilt especially in the Touraine and the valley of the Loire. That of Chenonceaux, begun about 1518, was built on stone piers and arches spanning the river Cher. A smaller example is Azay-le-Rideau (1518-1524), where despite the symmetry of its façade and the architectural vocabulary of the Renaissance, the visible roofs designed as semi-independent units, the round turrets at each angle, and even the machicolations of medieval military architecture persist. The Château of Ancy-le-Franc (1538-1546) by the Italian architect Sebastiano Serlio exhibits a fuller appreciation of the properties of Renaissance architecture. The dormer windows, too, have so dwindled in size as to be unimportant, but the building still enclosed a court and retained the towerlike shapes at the corners.

The bitter struggle of the Huguenots and the Catholics during the successive reigns of the three sons of Henry II made the last half of the 16th century unproductive. Architecture began to revive under Henry IV of Navarre (r. 1589-1610) when the foundations for the later French supremacy in Europe were laid. During the 17th century, the last traces of the medieval castle faded away from the châteaux and palaces, centuries after those forms had lost the military reason for their existence. The palace of the Luxembourg (1615-1620) in Paris, in the style of Henry IV, was built after his death for his widow, Marie de Médicis. In her childhood she had known the newer parts of the Pitti Palace in Florence designed by Bartolomeo Ammanati, and to aid her architect, Salomon de Brosse, she had drawings of that edifice sent up from Florence. Hence, we find in the garden front of the Luxembourg rusticated orders applied to each of the three floors with some use of triangular and segmental pediments. On the other hand, pavilions with prominent roofs ter-

minate the façade and create vertical accents to contrast with the adjacent horizontal parts. The central bay of the garden front also projects and has its separate roof; its verticality is further accented by special emphasis given to its design. Thus the system of towers and curtain walls of the medieval fortress has been perpetuated for its rhythm in design. Although most parts of the Luxembourg are still only one room and a corridor in depth, at least the corner pavilions contain groups of four interconnecting rooms. Like the castle, the Luxembourg enclosed a square court, but a prophetic change has been made therein. The main part of the palace at the back of the court is three full stories in height, but the wings are only two stories, and the entrance front has been reduced to single story screen with hardly more function than to provide privacy.

The Château of Maisons-Laffitte (1642-1650) near Paris, designed by François Mansart, illustrates the next significant step. Although the plan resembles that of the Luxembourg, the mass of the building is quite different. The court has now vanished as an architectural element, but its location and extent are preserved in landscape design as a terrace with surrounding balustrades. That age-old feature will be retained henceforth for privacy only in the larger hotels within the cities. The elimination of the sense of confinement, the opportunity for unhampered circulation of air, perhaps for somewhat better lighting, and for uninterrupted views of the gardens speak of the changed conditions of life. But if the enclosed court is gone, the French tradition in other respects has not. The corner rooms of the first and second floors project at the ends of the façade and are emphasized in design by pilasters and special treatment of the windows. The central bay also is accented both by its richer architectural treatment and by its three-story height. Separate roofs cover each of these sections. Except for the vestiges of the court, Louis le Vau adopted the same scheme for the Château of Vaux-le-Vicomte (1657-1660) designed for Nicolas Fouquet, the minister of finance during the minority of Louis XIV. Here, however, the plan is two rooms in depth, and the oval salon projects from the façade as the central pavilion.

Finally in the immense palace at Versailles, the last traces of the medieval tradition almost vanish. To give here even the briefest history of Versailles is unnecessary, though we may observe that the palace as a whole, and particularly the suite of state apartments on the garden front, perfectly express that extreme centralization of government and of society in the court, its formality, pomp, and circumstance characteristic of the age of Louis XIV. These state apartments form a double file with the Hall of Mirrors occupying most of the main floor. In the center of the garden front, a free standing colonnade of six shafts at the second floor level rests on an arcaded ground story, while toward but not at the ends, similar four-columned pavilions are found. Here is the last trace of the medieval tower and curtain wall. The pavilions serve no function other than design; they do not correspond, as did their predecessors at Vaux-le-Vicomte, to separate rooms on the interior. Finally the pitch of the roof has been so reduced that it is no longer visible from the ground and therefore plays no aesthetic role in the building.

The medieval castle died with the feudal so-

ciety that brought it into being, but so firmly had it fixed its forms in the minds of the French builders that it took centuries for them to disappear. The picturesque appearance of the castles and their associations in song and story led at the time of the architectural revivals of the late 18th and 19th centuries to buildings modeled on them. Ardoch Castle, Dumbartonshire, is an example with its conscious asymmetry, its towers, and its battlements, but its basic arrangement, like the life it sheltered, was so foreign to the castles of the past that any resemblance to them derives more from sentiment than from architecture.

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EVERARD M. UPJOHN,
Professor of Fine Arts, Columbia University.

CASTLETON, kàs"l-t'n, village, England, in Derbyshire, 9 miles northeast of Buxton. It is situated at the bottom of a rugged limestone eminence on which stands a small Norman keep built about 1176, part of Peveril Castle founded by William Peveril in 1068. The castle is celebrated in Scott's novel *Peveril of the Peak*.

CASTLETOWN, kàs"l-toun, town, Great Britain, former capital of the Isle of Man; on Castletown Bay; 9 miles southwest of Douglas. Castle Rushen, traditionally said to have been founded by Godred the Dane in 947, probably dates from the time of Magnus (1252–1265). Nearby is the Old House of Keys where parliamentary sessions were held until the seat of government was moved to Douglas in 1862. Just east of the town is King William's College, founded in 1643. Pop. (1951) 1,749.

CASTOR or **CASTOREUM**, an odorous substance obtained from the dried perineal glands and their secretion of the beaver. As a medicine, it was formerly used as a stimulant and an antispasmodic. Although it is now principally used by hunters as a scent to bait traps, it is also used as an ingredient in perfumes.

CASTOR AND POLLUX (the latter called by the Greeks Polydeuces), the mythological sons of Tyndareus, king of Lacedaemon, and Leda, or according to some, of Zeus and Leda.

Homer relates that Castor and Pollux were the sons of Tyndareus and that Helen was the daughter of Zeus.

According to one legend, Leda, whom Zeus visited in the form of a swan, brought forth two eggs; from one issued forth Pollux and Helen, from the other Castor and Clytemnestra. Pollux and Helen, being the offspring of Zeus, were immortal; but Castor and Clytemnestra, begotten by Tyndareus, were mortal. The two brothers were inseparable companions, equally brave and spirited, and attached to each other with the fondest affection. Castor was particularly skilled in the art of handling horses, and Pollux was masterful in boxing and wrestling.

The three chief events in their mythology are: (1) They were among the heroes of the Argonautic expedition in which they acquired divine honors. A terrible tempest had arisen on the voyage and all aboard called on the gods to be saved. Suddenly there appeared over the heads of Castor and Pollux two starlike meteors, and the tempest subsided. From this time they were the patron deities of mariners and received the name Dioscuri ("sons of Zeus"). The name Castor and Pollux was given to the lights which are often seen on the masts of ships during a storm, the electrical phenomena known as St. Elmo's Fire, or sometimes as Ledeian Lights. (2) After their return they rescued their sister Helen from the confinement in which Theseus had for some time held her. (3) They wooed the two daughters of Leucippus, Phoebe and Hilaeira, carried them off, and married them. Idas and Lynceus, nephews of Leucippus, pursued them, and in the resulting quarrel, Castor killed Lynceus but was himself killed by Idas. Pollux avenged his brother's death by slaying Idas. However, full of grief for Castor, Pollux asked Zeus either to take away his life or grant his brother immortality. Zeus granted his request by permitting them to reside alternately one day on earth and the other on Olympus. However, it is uncertain whether the brothers were always together or always separate in their passage between upper and lower worlds.

Temples and altars were consecrated to them. In great perils, especially in battles, the ancients believed that they frequently appeared to mortals as two youths in shining garments, on white steeds, with meteors over their heads. The cult of the Dioscuri was established in Rome in 484 B.C. in homage for their supposed assistance at the Battle of Lake Regillus.

CASTOR AND POLLUX, the two stars Alpha and Beta in the constellation Gemini. Castor is a famous double star, actually a sextuple system, since both its visual components and its faint distant physical companion are all spectroscopic binaries. The two bright visual components have magnitudes of +2.0 and +2.8 and revolve about their common center of gravity in a period of over 300 years. Both components are of the spectral class AO, and their combined mass is 5.5 times that of our Sun. The system is about 47 light years away from us.

CASTOR OIL (*Oleum Ricini*), an important vegetable oil from the seeds of the castor plant, otherwise known as castor bean and to botanists as *Ricinus communis* of the family of Euphorbiaceae. The plant grows in both tropical and semitropical regions. In the tropics it

attains heights of 30 to 40 feet, and as a hardy annual as far north as Oklahoma and Kansas it grows as high as 12 feet. The seeds contain from 35 to 55 per cent oil with an average yield of 49 per cent. At one time considerable crops of castor beans were harvested in the United States, but at present around 90 per cent of these seeds are imported, mainly from Brazil. During a peak year about 277 million pounds of imported seeds reached the United States, but less than 7 million pounds of oil were of foreign origin. A record production of the oil in this country was of the order of 125 million pounds.

Castor oil is one of the few vegetable oils that is composed mainly of a single glyceride, this being true only of olive and tung oils. In the case of castor oil, something like 86 per cent is the triglyceride of ricinoleic acid, with smaller amounts of the glycerides of oleic, linoleic, stearic, and dihydroxystearic acids. Ricinoleic acid is at the same time an unsaturated and a hydroxy acid, being 12 hydroxy-9-octadecenoic acid, $\text{CH}_3(\text{CH}_2)_7\text{CHOHCH}_2\text{CH}=\text{CH}(\text{CH}_2)_7\text{CO}_2\text{H}$.

The oil is very commonly cold-pressed from the crushed seeds to yield the highest grade of oil. The press cake is then extracted with solvents for a commercial grade. Solvent extraction of the meal without pressing has commonly put other undesirable components into the oil, but this difficulty is said to have been largely overcome in a more modern process. The press cake or pomace contains material toxic to men and animals, and is used as a fertilizer, being rich in nitrogen compounds.

The general public thinks of castor oil as a common medicinal, but this accounts for a relatively small quantity. Castor oil is still considered to be a valuable and efficient purgative.

Castor oil is subjected to a variety of treatments before it is industrially useful. When acted upon by 15 to 20 per cent of its own weight of concentrated sulphuric acid and gently warmed, it apparently produces sulphuric acid esters, since it is a hydroxy acid, rather than a sulphonic acid as the term "sulphonated castor oil" would imply. The product is known to industry as Turkey-red oil and is employed in the dyeing and finishing of textiles. When heated and exposed to a current of air or oxygen, polymerization takes place and the product is known as "blown castor oil." It is used as a plasticizer in lacquers, artificial leathers, and similar materials. Minor processes are hydrogenation to waxlike substances and saponification to produce materials that blend with other soaps to increase lathering.

The major treatment of castor oil is dehydration, that is, removal of the hydroxyl group and an adjoining hydrogen to form another double bond, which also doubles the degree of unsaturation. Partial dehydration results in an oil that is nondrying but which blends with mineral oils. It has been used in lubricating aircraft engines and is valuable in brake and hydraulic fluids. Most of the product is fully dehydrated by heating the raw oil to 250° to 300°C. under vacuum in the presence of catalysts. The hydroxyl group may be acetylated or reacted upon by free dehydrated ricinoleic acid to facilitate the transformation. The product is then a true drying oil and an excellent vehicle for paint pigments.

W. T. READ.

CASTOROIDES, kās-tō-roī'dēz, a giant ex-

tingent beaver of the Pleistocene epoch in North America. It was nearly as large as a black bear, had complex grinding teeth, and inhabited the cold swampy evergreen forests of the north. Its remains are found chiefly in peat bogs along with bones of mastodons.

CASTRAMENTATION, kās-trā-mē-tā'-shūn, an archaic term referring to that part of military science which deals with the principles and methods of laying out camps and the disposition of troops therein. Some of the main principles of the art of castramentation remain sound. These pertain to (1) the selection of camp sites with suitable physical characteristics (adequate water supply, terrain suitable for defense and maneuver, disease-free areas, available supplies of fuel); (2) the essential measures for protection of the camp (outposts and patrols to guard against surprise, protected flanks, prepared positions and defenses); (3) the disposition of the various elements and weapons of the troops so that they can quickly occupy their positions for battle and can properly support each other. And (4), the main feature of the art of castramentation, the one allotted the greatest space in dissertations on the art, dealt with the compact, methodical arrangement and precise alignment of troops and their facilities within the camp, principally to facilitate control and administration. Technological advances in weapons have outmoded this practice. Compact and methodically arranged camps as envisaged under the art of castramentation would today present themselves as inviting targets for long-range artillery fire and attack by aircraft, and losses sustained by such attacks would be enormous. Consequently, forces within range of an enemy are disposed in camps with a view to minimizing losses from artillery and air attacks. This requires dispersion of troops, concealment, and taking advantage of natural protection afforded by terrain features—factors that militate against orderly arrangement. The term castramentation is no longer in general military usage.

VINCENT JOSEPH ESPOSITO,
Colonel, United States Army; Professor of Military Art and Engineering, United States Military Academy.

CASTRATION, kās-trā'shūn, excision of one or both testicles (orchidectomy) or ovaries (oophorectomy). In the female, removal of the ovaries is sometimes referred to as female castration and in veterinary medicine it is known as spaying; the term castration usually refers to the male sex. The operation is employed to render horses and bullocks more docile especially in the presence of the opposite sex as well as to improve the breed. In most farm animals it serves to improve the quality of the meat, cattle and swine being mainly involved. In smaller animals such as dogs and cats the principal object of castration is to prevent wandering; in cats it is performed to make the tomcat acceptable as a house pet. Anesthesia is generally used for small animals, but in the case of colts and bullocks it is often unnecessary, the animals being controlled by a twitch, the stocks, or a maneuver known as casting, or by roping on the open range. There are two types of operation. In the first the scrotum is opened with a single stroke of a sharp knife, all coatings being severed. The testicle is then seized and removed by a metal emasculator

which crushes the spermatoc cord and lessens bleeding. In the case of unruly stallions anesthesia in the standing position is often advisable. In the second method the so-called bloodless operation is carried out with a special forceps which crushes the spermatoc cord through the skin. When the proper technique is employed results are said to be excellent, the testicle undergoing atrophy in about three months with loss of sexual propensities. It has the advantage of avoiding infection and is especially useful in castrating young rams where open operation has a high mortality. Colts are usually castrated at from six months to one year, and calves and pigs at from six weeks to six months. In older animals malignant disease of the genital organs may require the operation.

In human beings castration has a history extending over thousands of years. It was performed on Roman slaves to avoid procreation and has been common in all Oriental countries. Among the Chinese, up to the reign of the late empress dowager, the court swarmed with eunuchs who often occupied positions of trust and importance within the inner circle. An aspirant for such a place, where contact with women was unavoidable, was required to undergo the operation in a designated house where the operators were members of families practicing the art for centuries. In Italy, up to the close of the 18th century, boys were castrated young to preserve their high-pitched voices for the papal choir. The practice was forbidden by Pope Clement XIV about 1770. Castration in human beings is now looked on as a medical procedure indicated for malignant disease, advanced tuberculosis, undescended testicle, and as an elective procedure in operations for large hernias.

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HAROLD WELLINGTON JONES, M.D.

CASTRATO, kās-tra'tō, a term used to designate the eunuchs who were much in demand as leading singers in the opera companies of the Continent and England during the 18th century. From the 16th through the 18th centuries the castration of singing boys was commonly practiced in Italy. In manhood the castrati possessed voices with the range and flexibility of sopranos and altos and with a lung capacity equal to or even greater than that of an adult man. The castrati were employed in the church choirs of Rome and elsewhere but they were most popular in opera. Most of the operas of Handel contained parts for male sopranos, and the fact that these parts cannot be performed satisfactorily by women is one of the reasons for the few performances of Handel's operas today. The most famous of the Italian castrati were Francesco Bernardi Senesino (c.1680–c.1750), Carlo Broschi, called Farinelli (1705–1782), Gaetano Majorano, called Caffarelli (1703–1783), and Giovanni Carestini (c.1705–after 1758). The part of Orfeo in Gluck's opera was one of the most famous roles written for a castrato.

CASTREN, kās'trān, Matthias Alexander, Finnish ethnologist and philologist: b. Tervola, Kemi, Finland; d. Helsingfors, May 7, 1852. He studied Greek and Latin at the University of Helsingfors and made various excursions into Finnish Lapland and Karelia tracing out the vari-

ous branches of the Finnish race and language. In 1851, returning from a journey to the Samoyeds, Castrén was appointed professor of Finnish and old Scandinavian at the University of Helsingfors. The following year, just before his death, he was promoted to the position of chancellor. Among his works are *Elementa grammatices Syrjænae*, *Elementa grammatices Tscheremissæ* (1844), *De affixis personalibus linguarum Altaicarum* (1850), and his translation of the *Kalevala*. He is considered the founder of Ural-Altaic philology.

CASTRES, kās'tr' (ancient CASTRA ALBIENSIS, kās'trā āl-bī-ēn'sī-ūm), city, France, in the department of Tarn; on the Agout River; 24 miles south of Albi. The town hall, a work of Jules Mansart, contains a Goya museum and has a garden laid out on the plan of the Tuilleries. Nearby is the Church of Saint-Benoit, a 17th century cathedral. There are large textile mills and furniture factories; other industries include metalworking, tanning, and brewing. The town, founded on the site of a Roman camp, arose around a Benedictine monastery which was built in 647. It was annexed to the crown in 1225 but surrendered to Simon IV de Montfort l'Amaury during his crusade against the Albigenes. In 1356 it was made a countship, and after a period of confiscation was again united with the crown in 1519. From 1317 to 1789 it was an episcopal see, throughout the religious wars having supported the Protestant cause. In 1629 the town surrendered to Louis XIII who ordered its fortification to be razed. Pop. (1946) 30,781.

CASTRIES, kās-trē', MARQUIS DE (CHARLES EUGÈNE GABRIEL DE LA CROIX), French marshal: b. Castries (Hérault), France, Feb. 25, 1727; d. Wolfenbüttel, Germany, Jan. 11, 1801. The son of a general officer, he was brought up by his uncle, the archbishop of Albi, and at 16 entered the army. He participated in all the wars in Flanders and Germany from 1743 to 1763. As minister of the navy from 1780 to 1787 he instituted many reforms, and it was during this tour that he was promoted marshal (1783). A royalist refugee in 1791, he was warmly welcomed by the duke of Brunswick, his one-time foe whom he had defeated in 1760 at the Battle of Closter-camp. From 1797 until his death he headed the cabinet of Louis XVIII at Blankenburg.

His son, ARMAND CHARLES AUGUSTIN DE LA CROIX (1756–1842), fought as general officer in the French army in the American War of Independence. He was a deputy at the session of the States General in 1789. An émigré, like his father, he returned to France after the restoration of the Bourbons, was promoted lieutenant general, and created a peer of France.

A descendant of these soldiers is Brig. Gen. CHRISTIAN DE CASTRIES (b. Paris, Aug. 11, 1902), whose heroic defense of Dien Bien Phu in north-west Vietnam in the spring of 1954, with about 10,000 French and French Union troops against from four to six times that number of Communist Vietminh besiegers, ranks as one of the most glorious feats of arms of the post-World War II period.

CASTRIES, kās-trē or kās'trēs (also called PORT CASTRIES), seaport, British West Indies, capital of Saint Lucia Island in the Windward Islands. The city shuttled between English and

French control but it has been English most of the time since the French settlement in 1650. It has an excellent landlocked harbor, and is a coaling station; during World War II it served as a naval base. Its exports include sugar cane, rum, molasses, cacao, fruits, and essential oils. Pop. (1946) 7,146.

CASTRIOTA, George. See SCANDERBEG.

CASTRO, kās'trō, Américo, Spanish scholar: b. Rio de Janeiro, Brazil, May 4, 1885. Educated at the universities of Granada, Paris, and Madrid, he was awarded his Ph.D. degree in 1913 by the last named. Appointed professor of the history of the Spanish language at Madrid in 1915, during the succeeding quarter century he spent many years abroad, as visiting professor at the University of Buenos Aires, Columbia University, and the universities of Berlin, Wisconsin, and Texas. In 1940 he received a regular faculty appointment to Princeton and is now emeritus. Among his more recent works on Spanish history and literature are *España en su historia* (1948), *Aspectos de vivir hispánico* (1949), *Ibero-americana* (1953), and *The Structure of Spanish History* (1953). He has also edited many scholarly editions of Spanish classic authors.

CASTRO, kās'trō, Cipriano, Venezuelan general and dictator: b. Capacho, Venezuela, Oct. 14, 1858; d. San Juan, Puerto Rico, Dec. 5, 1924. On May 23, 1899, he invaded Venezuela and led a successful revolt against President Ignacio Andrade, after which he declared himself "supreme military commander." On March 30, 1901 he became provisional president and served until elected president, Feb. 20, 1902. His administration was marked by despotism and numerous revolts. He involved his country in dangerous quarrels abroad, the most important of which were those with European creditor nations during 1902-1903, with the United States over confiscated property 1904-1908, and with Colombia and France in 1905. While on a trip to Europe he was deposed by a revolution led by Juan Vicente Gómez in 1908; he made several unsuccessful attempts to return.

CASTRO, Cristobal Vaca de, Spanish colonial administrator: b. 1492?; d. 1558. A member of the audiencia of Valladolid, he was sent to Peru by Charles V in 1540 to advise with Francisco Pizarro (q.v.) regarding conditions prevailing in the country. Learning on his arrival at Popayan of the assassination of Pizarro he assumed the reins of government and undertook suppression of the revolt headed by the younger Diego de Almagro (q.v.). He defeated Almagro at Chupas on Sept. 16, 1542, and had him executed at Cuzco for treason, and thereafter continued to administer the country until the arrival, early in 1544, of Blasco Nunez Vela, first viceroy of Peru. Imprisoned on suspicion of conspiring against the humanitarian "New Laws" passed at the instance of Bartolome de Las Casas (q.v.), he was sent back to Spain in disgrace; eventually he succeeded in clearing himself of all charges.

CASTRO, Ines or Inez de, Spanish noblewoman: b. 1320?; d. 1355. In 1354 she was married to Dom Pedro, son of Alfonso IV, king of Portugal, whose mistress she had already been

and whose wife, Constantia, had died in 1345. Because she was a member of the rival Castro family, Alfonso was persuaded that his son's union with her threatened his dynasty and resolved to put Ines to death. The first time that Pedro left Ines, the king hastened to Coimbra, where she was living in the convent of Santa Clara with her children. The arrival of Alfonso filled the unhappy lady with terror. She threw herself with her children at the king's feet, and begged for mercy. Alfonso was softened, but afterward gave his counsellors permission to commit the murder, and it was executed that very hour. Ines expired under the daggers of her enemies. She was buried in the convent where she was murdered. Pedro took arms against his father, but soon became reconciled to him. Two years later Alfonso died; the assassins had already left the kingdom and taken refuge with Pedro the Cruel of Castile. An exchange of fugitives was carried out. Of the three murderers of Ines, one escaped, but the other two were tortured in the presence of the young King Pedro at Santarem in 1360. Their hearts were torn out, their bodies burned, and their ashes scattered to the winds. Two years later, it is said, King Pedro at Cataneda declared on oath that after the death of Constantia he had obtained the consent of the Pope to his union with Ines, and had married her. The archbishop and Lobato confirmed the assertions of the king; and the Papal document to which the king referred was publicly exhibited. The king caused the body of Ines to be disinterred, and placed on a throne, adorned with the diadem and royal robes, and required all the nobility of the kingdom to approach and kiss the hem of her garment, rendering her when dead that homage which she had not received in her life. The body was interred at Alcobaça, where a splendid monument of white marble was erected, on which was placed her statue, with a royal crown on her head. The history of the unhappy Ines has furnished many poets of different nations with materials for tragedies, and the Portuguese muse has immortalized her through the pen of Luiz Vaz de Camões (q.v.), in whose celebrated *The Lusiad* the history of her love is one of the finest episodes.

CASTRO, João de, Portuguese navigator: b. Lisbon, Feb. 7, 1500; d. Ormuz, India, June 6, 1548. In 1538 he accompanied the viceroy Garcia de Neronha, his uncle, to India, as commander of a vessel, and in 1540 was in the expedition that explored the Red Sea, of which he made charts and records of considerable scientific value. In 1543 he was made commander of a fleet to rid the European seas of pirates, and two years later he was sent as governor to Portuguese India. He defeated Mahmud Shah III, king of Gujarat, relieved the city of Diu, and subjugated Malacca. King John III appointed him viceroy of Portuguese India in 1547. The *Roteiros* (logbooks) of his voyages, of considerable interest, were published in Lisbon (1833, 1843, 1872). A statue was erected in his honor. It stands over the gate of the principal entrance to Goa.

CASTRO, José María, Costa Rican statesman: b. San José, Sept. 1, 1818; d. 1893. He was educated at the University of León, Nicaragua, and held positions under the government of

Costa Rica. He was elected president for a two-year term in 1847. For his part in obtaining Costa Rica's independence from the Central American states in 1848, he received the official designation "Founder of the Republic of Costa Rica." He again served as president from 1866 to 1868.

CASTRO, kās'trô, town, Chile, Chiloé Province, on the east coast of Chiloé Island, 45 miles south of Ancud. The town, founded in 1567, was sacked by Dutch pirates in the 17th century and was destroyed by earthquake in 1837. Saw mills and textile factories flourish; lumber and potatoes are exported. Pop. (1940) 51,867.

CASTRO DEL RIO, kās'trô' thêl rē'ô, commune, Spain, in the province of Córdoba, 22 miles southeast of the city Córdoba, on a slope above the Guadajoz River. The more ancient portion is surrounded by ruined Moorish fortifications, flanked with towers and entered by one gate. The modern portion is outside the walls and extends along the foot of the hill on its north side. Most of the streets are wide and regular, lined with well-built houses and handsome public edifices. There is a 15th-century church as well as several convents, colleges, and schools. Lumbering is carried on and woolen cloth and earthenware are manufactured. There is considerable trade in agricultural produce. Pop. (1940) 15,916.

CASTRO-URDIALES, kās'trô-ôor-thyā'lās, seaport and municipality, Spain, in Santander Province, on the Bay of Biscay; 30 miles southeast of Santander. An ancient Roman colony, the town has a medieval castle and a parish church. Destroyed in 1813 by the French, it has grown rapidly since 1879 through the development of neighboring iron mines and increased railway facilities. Fishing and canning of fish, especially sardines in oil, are thriving industries. Iron is the largest export. Pop. (1940) 11,963.

CASTRO Y BELLVIS, kās'trô ê bêl-y'vês, **Guillén de**, Spanish playwright: b. Valencia, Spain, 1569; d. Madrid, Spain, July 28, 1631. Descended from an old aristocratic but impoverished family, Castro was captain of the coast guard of Valencia in 1593. After being governor of Scigliano in the Kingdom of Naples in 1607, he made Madrid his home and there gained the patronage of the Marquis of Peñafiel. He was married in 1595 and again in 1626.

His literary fame rests chiefly on his remarkable play in two parts, *Las Mocedades del Cid* (1599?), which, when adapted by Corneille, resulted in the first tragedy of the French classic theater. Castro was a friend of Lope de Vega in whose dramatic pattern he followed. He also seems to have been obsessed with the works of Cervantes as well as deriving inspiration from popular ballads. A remarkable example of the latter is his robust tragedy *El Conde Alarcos*. In another of his outstanding plays, *Los Mal Casados de Valencia*, he deals rather unsympathetically with the institution of marriage. Among the Spanish playwrights of the Golden Age, Guillén de Castro stands close in importance to the Big Three (Lope de Vega, Calderón, and Ruiz de Alarcón) for the dramatic force and vividness of his plays, his uncanny knowledge of human nature, and his mastery of style.

CASTROGIOVANNI, city, Sicily. See ENNA.

CASTROP-RAUXEL, kās'trôp-rouk'sêl, or **KASTRO-RAUXEL**, city, Germany, in North Rhine-Westphalia, formerly in Westphalia, on the Rhine-Herne and Dortmund-Ems canals. Manufactures include chemicals, textiles, liquor, and building materials. Through the incorporation of Castrop and neighboring communities including Rauxel, the new town was formed in 1926. Pop. (1950) 69,547.

CASTROREALE, kās-trô-râ-â'lâ, commune, Sicily, in Messina Province. About 20 miles southwest of Messina, in the Peloritani Mountains, it is in a grape- and olive-growing region. Its hot baths have made it a health resort. Pop. (1936) 9,044.

CASTRUCCIO CASTRACANI DEGLI ANTELMINELLI, kās-trôôt'chô kās-trâ-kâ'nê dâ'lyê ân-tâl-mê-nêl'lê, Italian soldier: b. Castuccio, near Lucca, Italy, March 29, 1281; d. Sept. 3, 1328. A Ghibelline leader and a *condottiere*, he served in Flanders, Lombardy, and central Italy; in 1316 he was elected lord of Lucca. He finally defeated the Florentines in 1325, the year in which Louis the Bavarian created him duke of Lucca. After capturing Pisa in 1327 he became imperial vicar.

CASTUERA, kās-too-â'râ, town, Spain, in the province of Badajoz in Estremadura. The inhabitants are engaged in weaving and making earthenware. Other industries include tanning, flour-milling, and extracting olive oil. Pop. (1940) 8,945.

CASUARINA, kâzh-û-â-rî'nâ, the single genus of the family Casuarinaceae, also known as beefwoods or she-oaks. There are about 30 species, native chiefly to Australia. They are jointed leafless trees or shrubs, having their male one-stamened flowers in whorled catkins, and their fruits in indurated cones. *C. equisetifolia* is the best-known species, and is much cultivated in Florida and California and in other rather tropical regions.

CASUISTRY, kâzh-û-îs-trî, the science or art of determining cases of conscience and the moral character of human acts; so called from *casus conscientiae*, a case of conscience. Wherever the question arises, Is such an act allowable by moral law? there is a case of conscience and matter of casuistry, and in deciding the question for himself, as everyone habitually does, everyone is a casuist. But in current usage a casuist is one who, skilled in the prescriptions of the divine moral law and its interpretation whether by lawgivers, moralists or theologians, studies either supposititious or actual cases of conscience and judges whether a given act, or even a given thought, is consistent with or in violation of moral law—for, unlike the civil lawgiver or the ministers of civil law, the casuist must determine the moral character of thoughts no less, or rather more, than of acts.

The professional casuist is inevitable in the system of the Catholic Church, where the minister of religion, in his capacity of *confessarius*, or confessor, must be the counsellor and director of penitents and resolve for them questions

of guilt or innocence, questions touching the obligation to restitution, for example of goods, or reparation of damage to a neighbor's reputation by slander; granting or withholding absolution according to the merits. For the minister of the sacrament of penance acts under Jesus Christ's commission, whose sins ye shall forgive, whose sins ye shall retain, shall be forgiven or retained; and to execute that commission the minister of the sacrament must decide for himself and the penitent the moral character of the acts.

The science or art of casuistry has doubtless been carried to extraordinary lengths; but though the questions which it treats are such as touch individually and most intimately daily and hourly the many millions of souls who resort to the confessional, the works of writers on casuistry, though voluminous, would count as a scant armful compared with only one part of the works contained in a law library—those which record the decisions of the civil courts. It is true also and inevitable that casuistry like law lore is often employed as a means of escaping from legal penalty or of quieting the sense of guilt. As there are lawyers who for a fee will defend any cause however defenseless morally, even to the extent of working injustice—loss of property, loss of reputation to the party opposite—so there are casuists who by their over-inclining to an indulgent interpretation of the divine moral law, release or cut the nerve of moral responsibility, administer an opiate to conscience.

Probabilism is the name given to the doctrine which declares to be lawful *in foro conscientiae* an act the moral correctness of which is affirmed by any moral theologian of weight (*doctor gravis*); or, as defined by Alfonso Maria de Liguori, a probable opinion is one which rests on a solid foundation (*fundamento gravi*) both of reason and of authority, so that it is able to move the assent (*flectere assensum*) of a prudent man, though with fear regarding the opposite. But a writer in a great encyclopaedia, who regards probabilism as "the most remarkable doctrine they (the casuists) promulgated—a doctrine which it is hard to believe that any one ever ventured to assert"—teaches that "according to probabilism" "any opinion which has been expressed by a 'grave doctor' may be looked upon as possessing a fair amount of probability, and may, therefore, be safely followed, even though one's conscience may insist upon the opposite course": the last clause is gratuitous and has no warrant in the teachings of Catholic moralists, who unanimously hold that an act done in defiance of conscience, even be it a plainly erroneous conscience, is a sin.

Viewed in the abstract, the rule of the probabilists is not an unreasonable one; it is acted upon daily by whoever, doubting his own judgment, asks counsel of others whom he regards as trustworthy advisers, even though they be not grave doctors (*graves doctores*). It is admitted that some of the probabilists, even the greatest of them, as Escobar, Suarez, Busembaum, did not always guard the doctrine against misconstruction, and gave occasion for views of moral obligation which were too lax: but the ecclesiastical censure has fallen upon such erroneous teachings, without discrediting for Catholic moralists the principle of probabilism. Let any other school of moral teaching set to itself

the same task which confronts the moral theologian of the Catholic Church, that is, to define with precision the moral character of every act, every thought, every imagination that has relation to the moral law, and it will be seen whether probabilism must not have a place in its system.

CASUS BELLI, the material grounds which justify (or are alleged by one of the parties concerned to justify) a declaration of war (q.v.). The *casus belli* is not seldom a very trifling one, and does not necessarily indicate the real *causa belli* or cause of the war.

CASWALL, Edward, English divine and poet: b. Yately, Hampshire, England, July 15, 1814; d. Edgbaston, near Birmingham, Jan. 2, 1878. A younger son of the vicar of Yately, he was educated at Marlborough and at Brasenose College, Oxford, where he graduated B.A. in 1836 and M.A. in 1838. After ordination he received the perpetual curacy of Stratford-sub-Castle, Wiltshire, in the diocese of his uncle, the bishop of Stratford. He resigned the living shortly before being received in the Roman Catholic Church in January 1847. His wife dying two years later, in March 1850 he joined the Oratory of St. Philip Neri at Edgbaston, near Birmingham, which had recently been founded by his friend Dr. John Henry Newman. Caswall had met the future cardinal at the house of Lord Shrewsbury; he always attributed his conversion to the Roman Catholic faith to Newman's brilliantly persuasive writings. On the eve of seceding from the established church Caswall published a collection of *Sermons on the Seen and Unseen* (1846). Subsequently he attained note as a sacred poet. He published a number of devotional works, most of them translated from the French, and was author of *Lyra Catholica, Containing All the Breviary and Missal Hymns with Others from Various Sources* (1849); *The Masque of Mary and Other Poems* (1858); and *A May Pageant and Other Poems* (1865).

CASWELL, Richard, American lawyer: b. Cecil County, Maryland, Aug. 3, 1729; d. Fayetteville, N. C., Nov. 20, 1789. He was a delegate to the Continental Congress, 1774–1776, president of the Provincial Congress which framed the state constitution, and a major general of the state militia during the Revolutionary War. He was elected the first governor of the state, 1776–1780, and re-elected 1785–1787, and was a delegate to the convention which framed the federal Constitution.

CAT, Christopher, English tavern keeper: fl. 1703–1733. Keeper of a London tavern in Shire Lane near Temple Bar, Christopher Cat is remembered as the entertainer from whom the Kit-Cat Club (q.v.) derived its name. Though some authorities date the origin of this political club from the year of the Revolution of 1688, the generally accepted version is that it was founded 15 years later, in 1703, by leading Whig Party members at Christopher Cat's tavern in Shire Lane. When Cat moved to the Fountain tavern in the Strand, the club accompanied him there, unwilling to forego his famous mutton pies. The club's summer meetings were held at Upper Flask tavern, on the edge of Hampstead Heath, and occasionally the members met at Jacob Tonnson's house at Barn Elms. A portrait of Cat by

Sir Godfrey Kneller was shown in London at the Portrait Exhibition of 1867.

CAT, a predatory mammal of the family Felidae (q.v.). All feline animals are cats in the broader sense, but in the more restricted usage the term refers to the smaller long-tailed members of the genus *Felis*. Of these there are some 20 or 25 species, widely distributed except for Australasia and the Polar regions. All are nocturnal, solitary, and highly predaceous in habit, usually catching their prey by creeping up and springing on it rather than by running it down. Otherwise they are very diverse in both habits and habitat, desert and grassland forms being by necessity strictly terrestrial, while most forest types spend much of their time in trees. There is great variation in color pattern, sometimes even within the same species, from a plain reddish, yellowish, or gray to a spotted or mottled pattern. The various species can be only very briefly enumerated.

Starting with the forms in the Eastern Hemisphere most closely related to the domestic cat, we have the common wildcat (*Felis catus*). Forms probably belonging to this species are widespread in Europe, Africa, and southwestern Asia, though in many regions, particularly western Europe, true wildcats are now rare. All domestic cats are presumably derived from this species, particularly from the Egyptian form. The large-eared desert cat (*F. margarita*) is a related form ranging from North Africa to Central Asia. The jungle cat (q.v.) or chaus is similar to but larger than *F. catus*. Another relative is the small black-footed cat (*F. nigripes*) of South Africa. Other related desert cats are the Chinese (*F. bieti*) and the manul (q.v.). All the above mentioned species have coat colors which are variants of the tabby domestic cat pattern. Most of the remaining Old World species are more definitely spotted. The serval (q.v.) is a long-legged African species. The leopard cat is a widespread east Asiatic form. A close relative, the rusty-spotted cat (*F. rubiginosa*) of southern India and Ceylon is the smallest known feline. The larger fishing cat (q.v.) is another allied form. Two related Malaysian species, the flatheaded cat (*F. planiceps*) and the Bornean bay cat (*F. badia*) have almost no trace of pattern, being solid red, brown, or gray, though with lighter underparts. Another southeastern Asiatic species is the marbled cat (*F. marmorata*), notable for its extremely long tail. The golden cats are exceedingly variable as to pattern, ranging from plain orange types to definitely spotted forms. A southeastern Asiatic (*F. temminckii*) and a west African species (*F. aurata*) are generally recognized.

Turning now to the Western Hemisphere, we find that all cats, in a restricted sense, are essentially tropical, though a few reach southern Texas. The animals called wildcats in North America are really lynxes (see *LYNX*). Most of the smaller long-tailed American cats are more or less spotted. Largest and most widely distributed of these is the ocelot (q.v.). The margay is a smaller widespread form. Several other poorly-known spotted forms are known from South America. Two better known ones, both confined to southern South America, are the guinea (*F. guinea*) and Geoffroy's cat (*F. geoffroyi*). Perhaps the most remarkable of the South American forms is the Andean cat (*F. jacobita*). Confined to the high mountains of Bolivia and Chile, it has an exceed-

ingly thick warm pelt, unlike the other species of that continent. The pampas cat (q.v.) is another form with a mottled or banded pattern. The widely-distributed jaguarundi (see *JAGUARUNDI*) is devoid of marking, being either solid red or solid gray.

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CAT, Domestic. Human civilization appears hardly ever to have existed without the presence of the cat. Oriental women discovered very early that without the cat the grain that was stored for winter use would be consumed by rodents. The ancients also engaged cats to help them catch birds used for food and birds which destroyed the fruit and grain. In California, also, cats were formerly used to hunt linnets, which were destroying the fruit crops. (See Helen Hunt Jackson's *The Hunter Cats of Connorloa*, 1879.) For centuries in China and Japan they have protected the silkworm cocoons from rats, which would eat the pupae.

Because of rodents, colonists everywhere recognized the important place of the cat in any program for future prosperity. In England cats are kept in government buildings as rodent destroyers, and certain sums are allotted for their maintenance. Fighting large rodents requires more than mere feline courage and ingenuity. It calls for strong, well-nourished bodies.

In some Oriental lands the cat is known by the onomatopoeic name of Mau, but few countries exist where a person would not be immediately understood if he referred to a cat as "cat." Palladius, the Roman writer and agriculturist of the late 4th century, is thought to have first applied to the domestic cat the word *catus*, which still remains its specific name. Several thousand years before Christ, however, the tame cat in Nubia was called *Kadis*. The Egyptians, with whom the cat became the most sacred of their many sacred animals, called the male cat *Kut* and the female *Kutta*, and the Turks, who greatly admired the animal, called it *Kedi*. Here we see the evolution of the words "cat" and "kitty" from *Kadis*, *Kutta*, and *Kedi*. The Greeks called the cat *Katta*. For generations the Swedes have summoned the cat by calling "Kitty, Kitty." In some other countries the call is "Puss, Puss."

The cat frequently uses sibilants, and the sound of a sibilant is instantly caught by its quick ear, which perhaps explains the use of the word "Puss," though some Orientalists believe that Puss derives from Pasht (Bast or Bastet), the ancient cat goddess of Egypt.

Origin and History of the House Cat.—Charles Darwin observed that the origin of all our domestic animals will probably remain forever vague. What he said nearly a century ago still stands, and we have not discovered the origin of the cat. A small animal of Madagascar called the fousa is regarded scientifically as a primitive form of cat, and it has been suspected that various small carnivores including cats originated from an animal called *Miacis*, which lived in the upper Eocene period of the earth's history about 40,000,000 years ago. In the Oligocene epoch, however, which followed the Eocene in geologic history, no intermediate forms between *Miacis* and cats have been unearthed. The latest conclusion, therefore, is that cats arose by the law of saltation (mutation) or sudden appearance. True

cats of various sizes inhabited the earth many millions of years before man. Fifty or sixty extant species are found in nearly all parts of the globe, and some fifty species are extinct.

The wildcats of Europe, like so many other animals, world over, are now nearly extinct because of human persecution, but they are easily tamed if captured when young.

Big cats of 30,000,000 years ago differed very little from big cats of today, though some were much larger than the tiger. North America is still inhabited by five groups of wildcats, some numbering many species. They range in size from the jaguar down to the ocelot. The jaguar is the fiercest American wildcat; the puma or mountain lion, which is not a man-eater, would be friendly to man if permitted. The smaller jaguarundi, lynx, and ocelot have all been maintained as household pets and have usually proved one-man animals. American wildcats in general are larger than the house cat and no small feline related to house cats originated in the Western Hemisphere, where the wildcats are natural enemies and destroyers of domestic cats and no mating between the two has ever been recorded.

The domestic cat, however, will mate with Asiatic, African, and European wildcats, and it is naturally deduced that these species figured among its forebears. In fact, American domestic cats are known to owe their ancestry to an admixture of Asiatic and African tame cats with the several varieties of wildcats formerly common in Europe. Due to its wide distribution and small size, the house cat is necessarily the best-known member of the family of cats, great and small.

All house cats are of but one genus and one species, *Felis catus*. There are no subspecies or varieties of domestic cats, but many breeds or races (called also variations and variants) occur within the species, the same as among human beings.

Even the earliest domestication of the small cat is shrouded in mystery. When the Egyptians obtained the animal from Nubia about 5,000 years ago, it was already domesticated in India and China, and Indian scholars claim that wildcats, including the jungle cat and desert cat, were first domesticated in their country. The Egyptians tamed several breeds of native cats such as the Kaffir cat (*Felis caffra*), which bears a strong resemblance to our domestic cats in stripes, ringed tail, and letter M in the forehead. The jew's-harp in the forehead of many house cats appears to derive from Temminck's golden cat (*F. temminckii*), which ranges from India north through China and south through Indonesia.

Phoenicians are credited with having taken Egyptian cats to many foreign ports, and other seafaring men from the most ancient times are believed to have carried various breeds of cats on their voyages and introduced them here and there throughout the East. The domestic cat was well known in Crete by 1500 B.C. and is believed to have reached Greece later.

The origin of long-haired cats, which are found principally in China, Angora, Burma, Afghanistan, and Russia, is equally vague. There are few in Persia. For many years the Persian cat has come from Afghanistan, and it is commonly held that its main ancestor was Pallas' Tibetan cat (*F. manul*) of Central Asia. Strong evidence exists that long-haired cats were taken from China into Siberia and from Afghanistan into India, but Reginald I. Pocock, great British authority on

cats, believed that those which reached England had long been harbored in countries situated near the eastern end of the Mediterranean.

General Facts About Cats.—*Temperament.*—

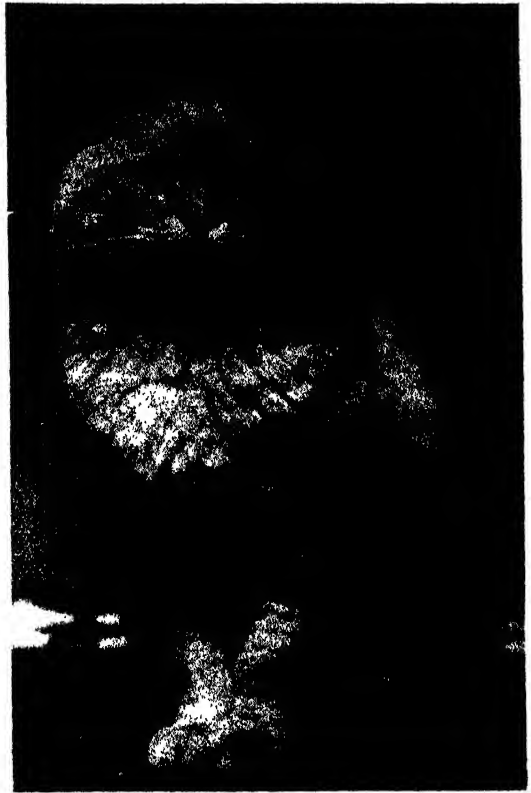
Cats are temperamental animals, playful and graceful, but reserved, timid, and high strung. They are independent and intractable and cannot endure restraint. Their affection for human beings and for occasional members of their own species is keen. They often select some member of the household as a favorite, and mother cats also have favorites among their offspring. They show emotion and have been known to weep. Their sense of companionship is strong, and they will protect unrelated animals and birds of the household yet prey upon the same species elsewhere. They jealously guard proprietary rights such as their own mouse holes and home comforts, and may suffer greatly if, once ensconced in a household, another pet is introduced. Under such circumstances many have died of grief. They are grateful for small favors. Curiosity is a dominant trait and they will help open packages and investigate every detail of unfamiliar surroundings. They can look a person steadily in the eye. They enjoy resting off the ground but, like many other animals, cannot bear to discover another creature of their species perched above them in the open. Cats have a sense of humor, and both cats and kittens smile. They dream during sleep and some observers think they are also given to daydreaming. Their patience and power of concentration are extraordinary, and their memory excellent. After an absence of six years a cat has been known to greet the members of the family, then go directly to its favorite napping place. A highly intelligent animal, it often exhibits remarkable reasoning powers. Its wits become sharpened when it is talked to, and it learns the meaning of a number of words. Cats dislike noise, though some enjoy music, instrumental or vocal, while others cannot tolerate it. The contented cat rests with forepaws folded beneath its breast. Like most male animals, tomcats fight, and are notoriously vocal about it. Cats teach themselves tricks and perform them happily on request, but cannot be coerced, and when exhibited in trick performances under compulsion, cruel usage may be suspected. As Rudyard Kipling said long ago, the cat "walks by himself." Love and gentleness effect much; rough treatment, nothing.

Physical Characters.—Some house cats appear to carry the blood of the fishing cats of the Orient and engage in fishing, also swimming, in salt or fresh water. Most cats prefer to keep their fur dry, however. Cats grow gray with age, and in the Siamese breed the mask becomes pale from grief or sickness. Like other members of the family Felidae, they purr. They possess mechanical ingenuity, and being natural imitators, can open doors and windows and ring bells. Many cats possess the homing instinct in a surprising degree, some having found their way home over hundreds of miles and with rivers to cross. All do not possess this instinct, however, and some are easily lost. They should be provided with a collar of leather or elastic, with name tag attached, bearing the owner's name and address. The voice of the cat, which covers two full octaves, presents a variety of expressions, its inflections conveying the meaning. The language consists of both consonants and vowels and covers a wide range of emotions. Cats spit, mew, hiss, growl, screech, and caterwaul. The body is lithe, with a loose

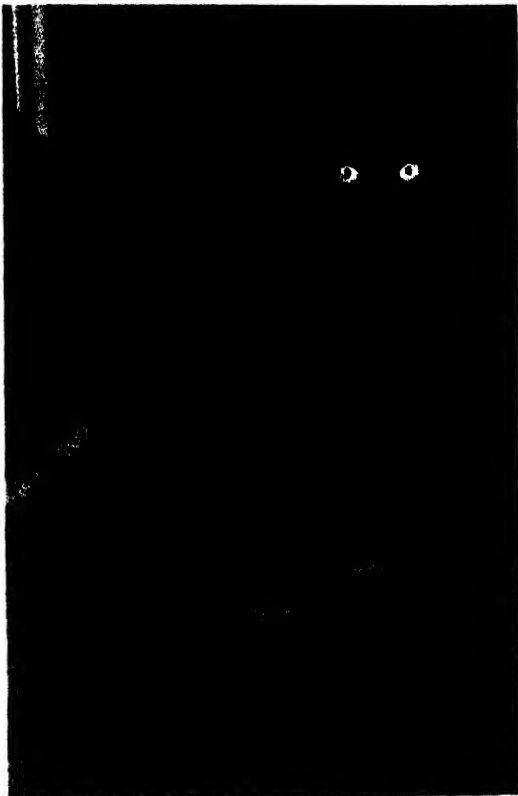
CAT



Ewing Galloway, N. Y.
Blue Persian cat.



Underwood & U
"Mamy," Turkish cat.



Black Persian cat.



Ewing Galloway, N. Y.
White Persian cat.

CAT



© Ewing Galloway, N. Y.

A thoroughbred Siamese cat.



© Underwood & Underwood

Straight-haired cat of common variety



© Underwood & Underwood

Wild cat



Chinchilla cat

© Underwood & Underwood

skin, and a flexible spine which permits the rearing of the back, and it is equipped with more than 500 voluntary muscles, over 230 bones, and about 50 vertebrae. The average length is about 28 inches in the male and 21 in the female, exclusive of tail. There is no breed of dwarf cats. The male cat averages a weight of from nine to seventeen pounds, the female six to ten pounds. Cats weighing 25 pounds have been exhibited at cat shows. The tail varies, and may be long, short, kinked, bobbed, curled, double, or missing. Kink-tailed cats, also tailless and stump-tailed cats, are common in Asia. The ears also vary, and a cat may have stiff ears, lop ears, or tufted ears. The animal is digitigrade, and the fore feet have five toes, the hind feet four. A cat with double paws, or one having a total of 24 toes, is not unique. The feet are adapted to climbing, and only the Manx cat can run long and rapidly. The claws are shed throughout the year, and the cat works off the loose bits of the front ones by scratching on soft wood, those of the hind claws being removed with the teeth. Cats do not sharpen their claws. They appreciate a scratching post covered with carpet and containing a little catnip. The milk dentition consists of 24 teeth, the adult teeth numbering 30. The coat is shed in summer. The cat's pupils contract by day and expand at night. It cannot see in total darkness, but sees best in a dim light. Its eyes vary in color and both eyes are not always the same color. In semidarkness they reflect rays of light of different colors, depending on the color of the tapetum or inner layer of cells of the eye, which may be blue, gold, pink, or green. The cat is one of several species of animals, including wildcats such as ocelots and lynxes, which, in falling, turn and land on their feet. This ability is believed to be due to the structure of the semicircular ear canals. It has nothing to do with the tail, for tailless Manx cats make the turn in falling quite as successfully as cats with truncated tails or long tails. Cats ordinarily need only two meals a day, with water to drink at all times; but during the breeding season both sexes require three or four meals a day. If the female's diet is lacking in minerals, such as a little salt or bone meal in her food, she may devour her young, like a dog or a pig. Cats are not wholly carnivorous, and while meat and fish constitute their main fare, they like grass, catnip, and vegetables, and many favor fruit juices and fruit such as cantaloupe. Like most other animals and also many birds, they are fond of milk, and other dairy products are also enjoyed. A sick cat will usually accept alcoholic liquors.

Reproduction.—The period of gestation varies, but averages 63 days. Females come in season for three to fifteen days about three times a year, and if unchecked will be nursing or carrying kittens almost continuously. Males are held best for breeding when from three to fourteen years old, females when from two to eight years, but fine kittens have been produced by much older cats. Some have bred when more than 25 years old. Fancy cats are customarily restricted to one or two litters a year, too many kittens being considered detrimental to their quality. The cat's fecundity is proverbial, and to prevent the cruelty of abandonment it is hoped that movements afoot throughout the United States for spaying female cats as well as neutering males not desired to perpetuate the breed will prove effective. The young commonly number four or five in a litter, though the Siamese cat may produce eight or nine.

Siamese kittens may be born with eyes open, and in this breed, unlike others, males can be trusted with the young until they mature. Kittens of other breeds are born deaf and blind, but with a sense of touch. In three days they can smell and taste, after which hearing is established and finally sight. Kittens purr and hiss before their eyes are open. Identical twins are born among cats as among other animals and are called also one-egg twins because they develop in the same embryonic sac and not in separate sacs like their siblings. Unlike fraternal twins, they are always of the same sex, weight, temperament, and color in coat and eyes. Female cats will suckle unrelated animals such as skunks, squirrels, rats, and even puppies—their willingness to do so depending largely on their supply of milk. In all species of Felidae, great and small, the mother carries her young in her mouth. Monstrosities also occur among cats. Two or more kittens may be joined together, a kitten may be born with eight legs, two heads, or two tails, or may lack some of its appendages.

Longevity.—The natural life span of the cat is reckoned as 14 years, but many reach 18 or 19, and some live much longer. Reliable records show that some have lived for more than 30 years.

Superstitions.—The common superstitions—that black cats have more electricity in their fur than those of other colors, that cats are occult, that those of one color are lucky and of another color unlucky, that they care more for places than for people, and that female cats mate with unrelated animals such as raccoons, skunks, and rabbits—are entirely without foundation.

Some Breeds of Cats in North America.—North America has been made familiar from time to time with a majority of the more than 30 breeds of domestic cats of Europe and the East. House cats are divided first into short-haired and long-haired groups, next into American short-haired and foreign short-haired cats, and finally into individual breeds.

Short-haired Cats.—We know that the striped tabby or tiger cat figured among the earliest ancestors of domestic short-haired cats, because animals gone wild commonly revert to type, and when cats go wild they assume the gray body color and black markings of the striped tabby. The tiger cat has been propagated in Europe for four known centuries. Its gray ground color is offset by black vertical stripes extending back from the shoulder, and one heavy black stripe runs down the back from the head to the tip of the tail, which is ringed with black. The two transverse lines characteristic of wildcats appear on either cheek, also the letter M in the forehead, with bars on the legs and chest (called bracelets and necklaces). The eyes are green or hazel. This cat is now exhibited only as a household pet.

The Brown or Blotched Tabby and Its Sub-breeds.—The brown tabby is believed to have arisen in Europe, west of the Mediterranean, more than two centuries ago. Through selective breeding the original gray body and green eyes have been replaced by a ground color of brown and orange eyes. The sides are marked with broad swirls or blotches, and a butterfly appears on each shoulder, dividing the lines of the head from those of the back, which consist of three parallel black stripes running from neck to tail. Sub-breeds are the silver tabby with green or hazel eyes, and the red tabby with orange eyes. Produced by artificial selection, their colors replace the original gray or brown ground color, with black

stripes in the silver tabby, but stripes of only a deeper orange than the body color in the red tabby. The letter M or a jew's-harp may appear in the forehead of the tabbies. Tortoise-shell cats, silvers, smoke cats, and cats of solid color evolved later. Tortoise-shells are much more rare than tortoise-shell-and-white cats, white being a dominant color in cats and difficult to outbreed. The true tortoise-shell carries no white in its coat and no tabby markings, but only red, black and yellow in distinct patches. The nose is half black and half orange, the eyes orange or copper. The tortoise-shell-and-white cat, commonly called tortoise-shell, has the same colors with white added. Males of these two cats are uncommon and apt to be infertile. A six-color male tortoise-shell-and-white cat was exhibited in California in 1946 in which the additional colors were blue and gray. A three-color male tortoise-shell was exhibited twice in Texas during the winter of 1952-1953. A fertile tortoise-shell male crossed with a black female has been known to sire a male tortoise-shell. Short-haired American cats of solid color are white with blue or yellow eyes, black, blue, red, orange, and cream or fawn, all having orange eyes. Foreign short-haired cats are the Siamese, Manx, Burmese, Abyssinian, and Russian blue. The best-known Siamese is the seal-point, first imported into the United States about 1895. The pale fawn-colored body carries brown points, that is, dark brown feet, tips of ears, tail and muzzle. The young are born white and develop the adult colors within a year. Other Siamese cats are the chocolate-point and blue-point, having these different points but the same ground color as the seal-point, and the red-point, which was produced in 1950 at the Jackson Memorial Laboratory in Bar Harbor, Maine. It is yellow with orange points. All Siamese cats have blue eyes. How the tailless Manx cat arrived on the Isle of Man is a question which the foremost scientists of Britain cannot answer. The Manx does not always breed true, and after many generations of careful selection kittens with long tails, bob tails and screw tails appear; but only a completely tailless cat, with a dimple where the tail begins in other cats, can be sold as a perfect specimen. It leaps and runs, but does not hop, has a double coat of varying color, and its hind quarters are slightly higher than those of other cats. The Burmese cat has a short, glossy, walnut-brown coat which is lighter on the chest and abdomen, with darker brown points, and its eyes range from golden turquoise to yellow. The tail may be slightly kinked near its extremity. The Abyssinian ticked cat has been common in the East since about a thousand years after the Pharaohs and is believed to have arisen as a mutation of the striped tabby by the breaking up of the stripes into spots and the spots into ticking, which also appears at times in ordinary tabbies. The coat sometimes shows the ancient tabby markings, but is usually gray or brown above and rufous beneath, each hair being tipped with dark brown, which produces the ticking. The nose is dark red edged with black, and the eyes green, hazel, or yellow. The ears are tipped and edged with black. Heels, paws, and toe pads are also black, and a black stripe extends down the back to the end of the tail. The Russian blue cat is the handsomest of the short-haired blues, a large and muscular animal with the heavy coat of cats accustomed to cold climates.

Long-haired Cats.—The Angora was the first long-haired cat in America and was brought from

Angora in Turkey to Maine and Massachusetts by mariners a century or more ago. In these states the pure breed may still be found. It is called the Maine cat, also coon cat, and at the earliest American cat shows it ranked above the Persians, which were first imported about 60 years ago; but the Angora breed no longer enjoys a show standing, having been completely eclipsed by the Persian cat.

The Angora is found in various colors and its fur is long and glossy with a bushy tail and Queen Elizabeth ruff. The ears and body are long and the face pointed. The Persian cat has a less glossy coat, more compact body (called "cobby"), smaller ears, a rounder head, and shorter legs than the Angora, but with ruff and bushy tail. Among the silver Persians of several breeds, including the chinchilla, all have green eyes. Smoke Persians have a silvery-white undercoat shading to smoke, a black top coat, with silver frill and ear tufts, and orange eyes. Brown tabbies, red tabbies, and silver tabbies, as well as cats of solid color, occur in the Persian group, also tortoise-shells, occasional blue torties in which the blue replaces black, blue cream (a two-color cat as the name denotes), and peke-faced cats which are red, orange, and red tabby, with indented noses and orange eyes.

Fashions change in cats, as illustrated in the case of the Angora, and the overwhelming popularity of the blue Persian and seal-point Siamese may give way to other breeds at any time.

A still rare breed is the Siamese-Persian, to produce which seal-point Siamese in Europe and America have been crossed with white, black, or silver Persians. The cat, as its name indicates, is a new breed of long-haired cat with Siamese markings. About five years are required to produce a new breed of cat and the work calls for ample space and the supervision of a geneticist.

Albino cats occur about once in 25 years, but do not establish themselves. A pair of albinos appeared in a litter of Siamese seal-point cats in California in 1947, an occurrence which may be repeated, as cats with blue eyes, such as Siamese and some white cats, are semialbinos.

Cat Shows.—Minor cat shows apparently began in New England with the Angora cat, but the world's first major show was inaugurated by Harrison W. Weir at the Crystal Palace in London in 1871. More minor shows followed in America and finally the first annual exhibition of cats took place at Madison Square Garden in New York City in May, 1895, with 176 entries. Ribbons, collars, cash, and other prizes were awarded. The most valuable cats exhibited were two short-haired tabbies, a male and a neuter, each priced at \$1,000, and the cat adjudged Best in the Show was a short-haired neuter with seven toes (color either red or blue). Two Angoras, a male and a neuter, were adjudged Best Long-Haired Cats in the Show. Though the earliest shows were conducted by men, women took them over and remain the principal exhibitors. Cat shows are held in various parts of Europe and America, winter being the preferred season, when the cats' coats are at their best. Veterinarians are present to guard against contagious diseases, and a committee is appointed to feed the exhibits. Valuations vary with the times, cats having been sold in America for from one dollar to \$2,000.

The Cat Fanciers' Association, Cat Fanciers' Federation, and American Cat Association carry a total of more than 130 member clubs dedicated to the breeding and showing of all breeds of cats.

The Siamese Cat Society of America, oldest Siamese club, is an independent organization. Stud books and registration blanks are issued by these societies, that cats and kittens to be sold may be properly recorded and pedigrees established. Registering a cat's name prevents its duplication. A cat is considered an adult when nine months old and kittens for showing must be between four and eight months of age.

Show classes cover kittens, neuters and spays, cats that have not won a blue ribbon, and various others. Ribbons in their order of importance are blue, red, yellow, and green. A Grand Champion and Grand Champion of Opposite Sex receive a purple ribbon or rosette. A white ribbon is awarded as a special prize. A blue ribbon counts for a certain number of points (usually ten) toward a championship, and prize winners in the championship class compete for Best Champion in the Show, the winner receiving points toward a grand championship. There are standards for long-haired cats, others for short-haired cats, each set of standards covering a total of 100 points, which include a specified number for coat and eye color, shape of head and body, condition of coat, etc. Each show is presided over by a competent judge. Breeders have effected remarkable improvements by taking advantage of spontaneous variations in color of body and eyes, shape of body, musculature, size of ears, and other characters. The cross eyes and kinked tail of the Siamese cat have been largely bred out, also the white "locket" which naturally appears at the throat of many cats and is considered a fault except in the Manx breed. America boasts of a magazine devoted to cats, also a National Cat Week, and besides the numerous clubs dedicated to breeding and showing cats, other associations exist solely for the protection of the cat, such as the Holyoke Kitten Club (Massachusetts), Allied Cat Lovers (Minnesota), and Federated Group (California).

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The cat is the most difficult of all animals to draw, and prior to the invention of the camera few artists, other than Henriette Ronner, succeeded in portraying the animal with any degree of accuracy. The work of some modern artists such as Peggy Bacon, Clare Turlay Newberry, Wanda Gag and Zhenya Gay, surpass almost all delineations of the cat attempted before the arrival of the camera. The most famous cat cartoons are those of Louis Wain, and the most celebrated photographers of cats are Ylla and Walter Chandoha.

IDA M. MELLEN,
Zoologist; Former Chief Aquarist of the New
York Aquarium.

CAT ISLAND, one of the Bahama Islands, in the Atlantic Ocean, northwest of San Salvador and southeast of Eleuthera Island. About 50 miles long and about 3 miles wide with an area of 160 square miles, it is the most fertile island of the archipelago, producing coconuts, sisal, sweet potatoes, pineapples, and bananas; forest trees include pine, cedar, and mahogany. This island was long identified with the Guanahani or San Salvador on which Columbus landed on Oct. 12, 1492. The

honor has been conceded to Watling Island. Pop. (1943) 3,870.

CAT OWL, a name applied in America to various owls, especially the great horned owl (*Bubo virginianus*), whose round face and earlike horns or feather tufts produce a feline visage.

CAT SHARK, the members of the Scyliorhinidae, a group of sharks characterized by having at least half the base of the first dorsal behind the origin of the pelvics; a non-lunate caudal and no connecting grooves between mouth and nostrils.

CATACHRESIS, kăt-ă-krě'sis, the metaphorical employment of a word to designate some object for which the language lacks a specific term—the *arms* of a chair. Catachresis also signifies the use of a word which does not correctly express the intended meaning, as when *aggravate* is used in the sense of *provoke*, or *infer* where the meaning is *imply*.

CATACOMBS. The word catacomb comes from the medieval Latin term *catacumba*, which itself derives from the Greek κατά (below) and κύβη (a hollow or declivity). It was first used to designate an area on the Appian Way some three miles south of Rome, where now stands the church of St. Sebastian above a subterranean catacomb of the same name. Modern excavations beneath this church, which had been originally dedicated to the apostles by Constantine, the first Christian emperor, revealed a steep ravine honeycombed with tombs where, according to early tradition, the bodies of Sts. Peter and Paul had at one time reposed. Because of its association with the two apostles, this cemetery, which was properly indicated as *ad catacumbas*, that is, "at the hollows," became a place of pilgrimage and remained accessible until the 9th century, when it and all the other underground burial places of the early Christians were forgotten. Its name, however, survived, and was eventually applied to all subterranean cemeteries of similar nature, whether pagan or Christian. In modern usage, therefore, the term has been loosely and improperly extended to cover every sort of underground area in which burials have been made or human bones deposited, from the rock-cut tombs of the ancient Egyptians, Persians, and Syrians, and the natural caves used as catacombs in Sicily, to the abandoned quarries similarly employed at Naples and Paris. Although many of these are romantically impressive and often of considerable historical and archaeological interest, they lie outside the bounds of our discussion, since the majority were used for pagan burials, whereas the others, originally quarries, were later adapted to sepulchral use both by pagans and Christians. Hence the catacombs here considered are those vast complexes of subterranean galleries, passages, stairways, and chambers excavated by the early Christians in the outskirts of ancient cities to serve specifically as cemeteries, that is, as resting places for the dead.

Although by far the most famous and extensive Christian catacombs are those of Rome, similar underground cemeteries exist throughout the Mediterranean area, scattered from Italy to Malta, Alexandria in Egypt, and Sousse in Tunisia. The Roman catacombs, however, surpass all others in religious, historic, and artistic interest, not only because they bear witness to the primary importance

of the vital Christian community which created them at the capital of the pagan Roman Empire, but also because they provide our earliest information, after the Gospels themselves, on the beliefs, the doctrines, and even the mode of life of the first organized Christian groups.

The Roman Catacombs.—Abandoned and forgotten in the 9th century, the Roman catacombs were rediscovered by isolated pilgrims and scholars of the Renaissance, although not until 1593, when Antonio Bosio (1576–1629) began his life-long studies and researches, did they receive more than cursory examination. With the posthumous publication in 1632 of his famous *Roma sotterranea cristiana* he laid the foundations for the study of what later became one of the most important branches of modern archaeology, that dealing with the antiquities of the early Christian church. Unfortunately, however, the course marked by Bosio was not followed consistently during the two subsequent centuries, so that the Roman catacombs were again neglected and even suffered greatly from vandalism and pillage. This trend was checked in the 19th century, and the modern era of intensive and truly scientific investigation was inaugurated by the great Italian scholar Giovanni Battista de Rossi (1822–1894), who in 1842 began a series of remarkable discoveries which, continued throughout his life and described in his monumental publications, rank him as the father of this branch of modern scholarship. Thanks largely to the inspiration of de Rossi, his researches were advanced still further by a number of brilliant contemporaries and successors, whose most important publications are listed at the close of this article. As a result of these continuing researches, no less than 50 separate catacombs, cut in the sub-soil to serve as places of burial, are now known to exist in the environs of Rome. The total length of their subterranean galleries approximates 550 miles and the total excavated area slightly less than 620 acres, providing accommodation in their labyrinthine depths for an estimated 6 million bodies.

Location.—The scattered disposition and individual peculiarities of the 50 or more distinct and unconnected catacombs which surround the city were determined by geological factors. Beneath the surface humus of the campagna there exists no uniform stratification, but instead varied masses of sedimentary and volcanic formations, the latter comprising large deposits of volcanic sand called *pozzolana*, reefs and ledges of hard red *tufa*, and isolated strata of the softer granular *tufa*. Of these three materials, the first two were highly valued for building, and had therefore been extensively mined and quarried by the ancient Romans; the strata of granular *tufa*, on the other hand, being too soft for structural uses, had remained undisturbed, and became the medium preferred by the Christians for the excavation of their catacombs. The reasons for this choice are obvious. In attacking the softer strata the Christians were sure of not infringing on the cuttings of their pagan persecutors; while the rock itself, though soft enough to be cut with pick and shovel, was sufficiently resistant to make possible the hollowing-out of the characteristic grave niches in the lateral walls of the passages without fear that the walls themselves would collapse. The *tufa* had, finally, the great advantage of being porous and, therefore, hygienic; it absorbed infiltrating moisture, a valuable characteristic for areas destined to receive so many corpses. Since the Christians

sought out by preference the underground masses of granular *tufa* for their sepulchral galleries, it is easy to understand why the various catacombs of Rome are not only distinct but also widely scattered. The geologic strata themselves were not continuous, and their own sporadic occurrence determined the isolation and wide distribution of the majority of Christian catacombs in the environs of Rome.

History.—The history of these cities of the dead spans a period of 800 years, beginning with the coming of Christianity to Rome at the middle of the 1st century and ending in the 9th, after many thousands of bones of the early martyrs had been stolen to serve as wonder-working relics enshrined beneath the altars of churches throughout Christendom. This long span of centuries divides into two main periods. The first was the era of persecution, from the martyrdom of Sts. Peter and Paul to the Edict of Milan in 313, when Constantine gave official recognition to the new religion. During this phase the catacombs were excavated and adorned to serve as resting places for those who died in the Lord. During the second period, which began with the triumph of Christianity, the catacombs declined as burial places and gradually assumed the role of hallowed shrines to which pilgrims came to venerate the relics of the saints. Eventually, however, with the violation of the sanctuaries by the removal of their relics, the old tombs gradually lost their power of attraction, and the catacombs themselves were abandoned and forgotten.

In order to understand how it was possible, in the centuries of persecution when the Christians themselves were often hunted down and martyred, for these proscribed groups to undertake and carry through the vast and costly task of creating the catacombs, it is necessary first to realize that the adherents of Judaism and other oriental religions established in Italy had long been privileged to prepare their own subterranean tombs and places of burial, and that the Christians were originally considered merely a heretical sect of Judaism. In the second place it should be noted that the earlier groups of Roman converts, far from coming exclusively from the lower ranks of the population as at one time supposed, in fact often included individuals of wealth and social position. Thus certain histories of early Roman martyrs tell how members of the aristocracy, wealthy patricians and noble ladies, piously gathered up the bodies of Christians who died for the faith and laid them to rest in their own private domains, proving that, besides slaves and artisans, there existed among the Roman Christians many rich and favored individuals, a few of whom belonged even to the imperial family. In the beginning, then, it was these wealthy Christians who undertook the expense of preparing the first catacombs, which were established on private properties belonging to the most illustrious converts to the religion of Christ. Their activities in this respect were also entirely legal, since the rights of the proprietor were absolute. He could receive and entomb on his own property outside the city whomever he pleased; and, once the body was deposited in its tomb, the universal Roman law intervened to assure its protection, declaring the grave a *locus sacer*, a place sacred and never to be disturbed. These legal dispositions and the ancient customs which backed them gave to the early Christians the means of assuring burial, without too great expense, to all members of their small communities. The Roman

catacombs were therefore founded and began their growth under entirely proper and legal auspices, and, whatever measures of proscription were launched against the Christians, they in general concerned only the living and rarely interfered with the abodes of the dead. This explains the names which came to be attached to the earliest cemeteries, such as the Catacombs of Domitilla, Praetextatus, and Lucina, so designated because they were excavated beneath the private burial plots of these well-to-do converts.

With the beginning of the 3rd century when the number of Christians at Rome had greatly increased and persecutions had intensified, the situation changed, and the status of the catacombs altered accordingly. It now became essential that the church should have its own burial places for the faithful, be they rich or poor; and so, from a donation made by an aristocratic family in the reign of Septimius Severus (c.193-211), the Christian community at Rome acquired a sepulchral area adjoining the crypt of Lucina on the Appian Way, which later became known as the Catacomb of Callistus from the name of the deacon to whom Pope Zephyrinus entrusted its management. Strange as it may seem, the existence of such church property, in the early 3rd century and during a period of the most violent persecutions, is attested by official documents which prove that, even in those difficult times, the Roman state permitted the Christian church to maintain its proprietary rights to the catacombs, although Christianity itself was then illegal and proscribed. The explanation of this seeming anomaly is generally held to reside in the great popularity and assured legal status of the contemporary *collegia funeraticia*, the "burial societies," also called *collegia tenuiorum*, "societies of poor folk," whose members were allowed by law to assemble monthly on a fixed date to make necessary arrangements in advance for the honorable burial of their members. Thus every *collegium*, whether Christian or pagan, set up its own treasury, elected officers to conduct its affairs, collected modest yearly dues from its members, and finally acquired outside the city a sepulchral area, which it excavated and caused to be prepared in common to provide a final resting place for every member. In this way, despite all persecution and proscription of the new religion, the Christian catacombs steadily expanded and increased in number until, with the final triumph of the faith in 313, they shortly ceased to be used as places of burial and assumed instead the role of venerated sanctuaries.

Early Christian writers, such as St. Jerome, Prudentius, and many others, bear witness to the devotion and respect inspired in the faithful from the 4th century onward by the tombs of the martyrs. Each year, on the day of their martyrdom, a solemn service of commemoration was held at the grave of the most illustrious victims of former persecutions now happily ended, when a subterranean mass was sung by candlelight, and processions of priests and celebrants moved along the gloomy galleries. Although such observances tended naturally to increase, it was largely through the enthusiasm of St. Damasus that the catacombs were developed as famous cult centers. The keen interest which this pope took in the old cemeteries during his pontificate (366-384) led him to carry out extensive works to make them more accessible and to render them more attractive to visitors. He thus caused certain galleries to be enlarged, stairways to be cut, and the tombs of eminent

martyrs to be redecorated and further signalized by metrical inscriptions, composed by himself with only mediocre poetical skill. The most famous of the underground chapels thus refurbished in the 4th century is the Grotto of the Popes in the Catacomb of Callistus, which received an altar and episcopal throne to honor nine popes, from Pontianus to Eutychianus, interred there. Although at this time many of the faithful still wished to be buried in the catacombs *ad sanctos*, that is, "near to the martyrs," all such burials ceased in the next century as a result of the evil days which then fell upon the Eternal City. With the sack of Rome by the Goths under Alaric in 410 and the subsequent pillage by the Vandals in 455, the inhabitants of the city no longer dared to venture beyond its walls to inter their dead in the catacombs. Instead they laid out more conventional graveyards in the devastated regions adjoining their urban churches.

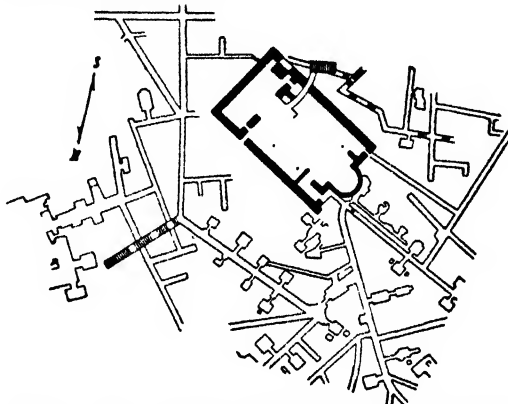


Fig. 1. Plan of part of Catacomb of Domitilla, with Basilica built above Tomb of Petronilla.

Description.—We have seen that the Roman catacombs, with their vast complex of passages cut in the soft tufa rock, are located for the most part outside the city walls and along the ancient roads which radiate through the campagna. Excavated well beneath the surface, the narrow corridors, whose average width is less than a yard, extend often to great length (Fig. 1). Twisting and crossing at irregular angles, they give the impression not only of boundless extent but of hopeless intricacy as well, an impression much increased by the fact that they are seldom confined to a single level. Indeed, the Catacomb of Callistus has as many as six different levels of excavation, each with its maze of intersecting corridors from which open out the *cubicula*, or burial chambers, of various size and shape (Fig. 2). Since the entire wall space of corridors and chambers alike was utilized to the utmost for burials, the *loculus*, that is, the individual tomb, is itself in most instances merely an oblong niche cut into the wall, just wide and deep enough to receive the body. Here and there, however, larger rooms appear, which served as crypts to enshrine the bones of the martyrs. On the anniversaries of these saints, and often, too, when persecution raged, religious services were celebrated in these hidden oratories, so that the latter served occasionally as churches.

Those early Christians who had the task of planning, excavating, and decorating the prodigious maze of the Roman catacombs bore the modest title of *fossores*, that is, diggers or "sappers." The foremen of the individual gangs of workmen must obviously, however, have been trained in the

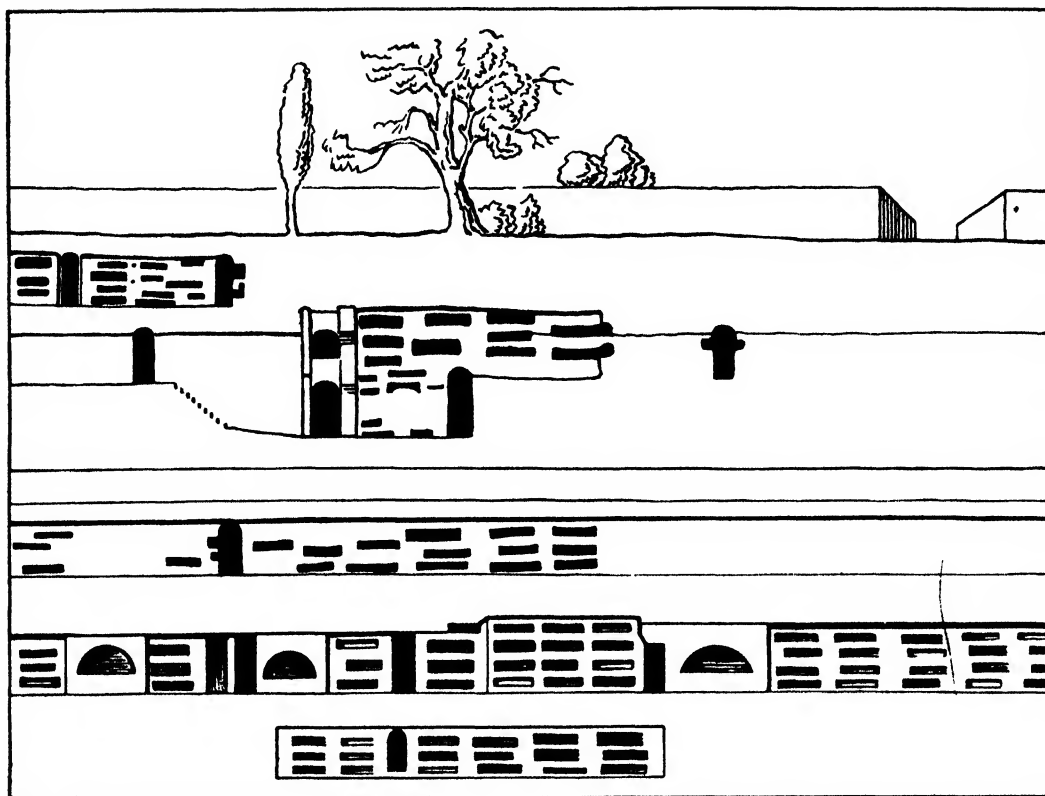


Fig. 2 Section of Catacomb of Callistus, showing six levels

exacting guild of Roman surveyors, the *agrimensores*, to have enabled them to cope with the unusual difficulties encountered in their subterranean labors. The nature of the obstacles they had to overcome can best be appreciated by recalling that they worked underground by the light of tiny flickering lamps, in a gloom which made it extremely difficult for their cuttings to follow a predetermined direction and thus avoid the waste of precious burial space. The disposal of excavated material was no less troublesome, since the greater part of it had to be carried laboriously to the surface on the backs of men, through passages so narrow that two workmen would be awkwardly cramped in passing. Yet generations of planners and laborers triumphed over all obstacles, carrying to completion through the centuries an unparalleled work of scientific skill and meticulous, exacting handicraft. Many frescoes show the fossors at work, mattock in one hand and a lighted lamp in the other. More frequently, however, they are portrayed on their tombs, as, for example, the 3d-century fossor Diogenes, who stands quietly in the painted niche above his grave, proudly bearing on his shoulder the mattock as symbol of his craft, his other tools disposed about him. In the early centuries such men even ranked among the minor clergy, as is indicated in this case by the swastika form of cross embroidered on his liturgical vestments (Fig. 3).

It is a significant fact that the entrances to the oldest Christian catacombs were of monumental aspect and opened directly on the main roads leading outward from the city. Thus the arcaded façade of the Catacomb of Domitilla, dating from the 1st century, is exactly like those of pagan tombs of the same period, its doorway leading to a vestibule from which stairways descend

to the labyrinth of corridors below. When the great persecutions of the 3d century were initiated, however, it became necessary to conceal the entrances, by placing them in open country far from the main routes, with nothing showing at the surface save a narrow stairway which could be quickly blocked and obscured. But, as the need for all such secrecy was removed by Constantine's edict of 313, the openings to the galleries were not only enlarged and beautified but often further signaled by the erection of a basilican church, dedicated to the memory of a famous martyr entombed below. A typical example of this is the basilica built above the tomb of Petronilla in the Catacomb of Domitilla (Fig. 1). We have already mentioned the subsequent efforts of Pope Damasus to make the catacombs more accessible to pilgrims.

At the entrance to the majority of catacombs a narrow stairway cut in the tufa leads downward from level to level, each marked by its maze of



Fig. 3. Arcossolium in Catacomb of Callistus with fresco representing the fossor Diogenes, 3d century.

galleries or *ambulacra*, the latter enlarged at intervals to become cubicles, which were generally excavated for well-to-do families or for the members of a *collegium*. The graves of the poorer Christians, however, were cut in the walls of the corridors, end-to-end and one above another so as to occupy the smallest possible amount of space (Fig. 2). In addition to these cramped loculi, three other types of tombs occur, namely, the *sepulcrum a mensa*, the *arcosolium*, and the sarcophagus. The last-named, a coffin of stone or marble often richly carved and hence extremely expensive, is not frequently found in the catacombs. The *sepulcrum a mensa*, or table tomb, is a somewhat more elaborate form of loculus divided into two equal parts in height, of which the upper is an entirely open rectangular niche. The lower half, which serves to receive the body, is hollowed out like a coffin and covered by a flat slab, thus suggesting a table (the coffin) set snugly in a niche of twice its height. The *arcosolium*, the most elaborate form of catacomb grave, resembles the foregoing save that the open space in the wall above the slab-covered coffin is cut in the shape of an arch, which makes a sort of canopy above the altar-like tomb (Fig. 3). This type, which came into use early in the 3d century, lent itself readily to decoration, realized generally in fresco but often carried out in applied revetment of colored marbles. From the artistic viewpoint it thus became the most important type of grave to be used in the catacombs.

Art.—To understand the art of the catacombs we must always bear in mind the fact that the earlier converts to Christianity were neither more nor less than Romans, or, at least, Latinized Greek and Oriental citizens of the vast Roman Empire. They were hence endowed with the classic background of the all-inclusive Roman culture. And, since the first adherents to the new faith were largely recruited in the more populous centers amidst the ferment of new ideas and doctrines preached by rival sects, early Christianity itself assumed a strongly urban and strangely cosmopolitan character. This significant, but generally disregarded, fact is pointed up in a graphic way by the epithet which the thriving Christian congregations came in time to apply to their rivals, more particularly to the less progressive groups of citizens who clung to the old traditional worship of the classic Olympian gods. As is generally the case, these more conservative and backward communities were those located in outlying rural districts, somewhat out of touch with more recent religious developments and naturally less exposed to the contagion of new ideas. These country dwellers, therefore, staunch adherents of the old religious beliefs, were mockingly labeled pagans, *pagani*, that is, yokels or country bumpkins, by the more sophisticated Christians of the crowded cities and towns.

That the fundamental basis of the life and thought of the early Christians was essentially Roman is amply demonstrated in all the forms of their art, most clearly in the catacombs and in their newly founded house of worship, the basilican church. The latter, indeed, clearly reveals the elements of which early Christian civilization itself was compounded, that is, its Roman classic core, on which was overlaid a thin veneer of mystic Eastern dogma. This latter component, however, the Oriental factor, was destined to receive an increasing emphasis during the first few centuries of our era. Originating in the East, the

new religion naturally embodied in its doctrines and basic concepts the mystic and lofty spirituality of the Orient. This, moreover, had been grandly focused in the person of a Founder who in all his recorded words and deeds had stood in direct opposition to the rational, objective, and non-spiritual ideals of classical civilization. Thus, from its very inception Christianity was by nature dualistic, drawing a sharp distinction between world and spirit, between the sinful flesh of man and the supreme goodness of God. Nevertheless, the ethical teachings of Christ, though accepted in theory, tended perhaps to be minimized by converts as yet unprepared to realize their full implications. On the other hand, the miraculous elements, the mystical ideas of spiritual regeneration through faith, of the salvation of the soul, soon crystallized in the form of dogma. It therefore happened that the converted pagans, who were called upon to express in the visible forms of art the ideals and doctrines of their new religion, found themselves faced by a difficult problem. The early catacomb artists, trained in the highly concrete and objective forms of Roman classic art, had now to present in terms of color and form a whole new series of concepts. Yet these new ideas, mystic and transcendental by nature, were by that very fact incapable of direct representation. How, for example, shall we paint the form of the Holy Spirit? How can we show in visible form the salvation of the soul, the resurrection of the body and life everlasting? This was the problem, more difficult by far than that which confronted the pagan artist. It admitted, of course, of but one solution—the use of symbols. From its beginnings in the catacombs, therefore, Christian art was necessarily symbolic.

Symbolism.—Although symbolism attained its peak in Christian art, its use for the representation of religious ideas had been common among all ancient peoples, so that, with such a long tradition behind it, the symbolic habit of thought came naturally to the Roman artists of the catacombs. Their task was rendered more difficult, however, by the fact that they had now to deal with abstract and mystical concepts. The first efforts of this great symbolic art and its early struggles with a mode of utterance still largely pagan are most graphically illustrated in the frescoes of the Roman catacombs. In completing a burial of the types described above, the tomb was tightly sealed with slabs of stone or tile, and upon this covering an inscription was cut or painted. In many instances, particularly in the larger crypts and cubicles, the rough tufa walls were smoothed and coated with stucco, and on this the celebrated scenes and decorations were painted in fresco. Among them, however, the modern observer is struck by the very significant and almost complete omission of any reference to the passion of Christ and, more particularly, to His crucifixion. This seems the more strange because in later centuries these subjects became of supreme artistic and religious importance. The truth of the matter is, of course, that the early Christians were much too close in point of time to the actual sufferings of their Lord to forget the ignominious nature of the punishment He had suffered, a punishment reserved in Roman law for the lowest and most desperate type of criminal. Small wonder, therefore, that even in the latest catacomb paintings the crucifixion was not represented or, in fact, the symbol of the cross itself. We could as well expect an obscure modern sect,

whose founder, let us suppose, had died at the hands of the law, to adopt for the supreme symbol of its faith the noose or the electric chair. Instead of the cross, then, we find in catacomb frescoes of the early 4th century the symbol known as the *chrismon*, the Constantinian monogram of Christ, which seems to represent schematically the flaming cross, said to have been seen in the heavens by Constantine at the Battle of the Milvian Bridge (Fig. 4). In this symbol, *chi* and *rho*, the first two letters of Christ's name in Greek, are superposed to produce a six-armed wheel-like form, which only remotely suggests the chief instrument of the passion. Later, however, when crucifixion as a punishment for criminals had long since been abolished and the stigma attached to this form of torture generally forgotten, the cross gained gradual acceptance as the chief symbol of the Christian religion.



Fig. 4. Chrismon, or Constantinian monogram of Christ.

Frescoes.—The catacomb paintings, done in rather brilliant colors in a sketchy rapid style, show close analogies to the well-known Roman frescoes at Pompeii. The earlier examples, at least, from the 2d century of our era, might well be mistaken for Pompeian work, particularly in their open composition and in their use of naturalistic ornament. Indeed, it is only in their symbolic aspect that their specifically Christian character resides. The actual scenes represented deal for the most part with incidents from the life of Christ, particularly the miracles, or with a restricted range of Old Testament stories. Among

employed in sepulchral art. Hence the majority of these scenes, repeated over and over with slight variation in the frescoes, symbolized in one way or another the idea of the salvation of the soul.

One of the earliest of these paintings shows Daniel in the lions' den. The prophet appears as a youthful nude figure of Roman classic type, his hands raised and extended in the pagan attitude of prayer, while on his right and left are posed in heraldic fashion two quite innocuous lions no larger than fair-sized dogs. The den or any other indication of surroundings is entirely omitted, since the scene, in deference to its purely symbolic purpose, is reduced to its lowest terms and presented in the simplest possible manner. In even balder simplicity is pictured the symbolic incident from the story of Noah. Upon a groundline which represents the waters of the flood the ark appears, quite literally as a cubical box or *arca*. From it emerges the upper part of a single draped figure, Noah, who stretches forth his hands to receive the sprig of olive from a dove fluttering overhead. The illustration of the story of Jonah naturally demanded a more extended composition, since three successive incidents had to be shown (Fig. 5). In the first a small Roman ship bears several oversize sailors, who hurl the unfortunate Jonah headlong into the sea. Yet the lurking whale that awaits with gaping jaws the disobedient prophet is no whale at all to modern eyes, but rather a typical hippogriff, the common classic sea monster. From snaky coils and splashing forelegs it rears a doglike head, the jaws of which are studded with bristling fangs. Immediately adjoining, we again see the monster in much the same attitude as before, but here its head is toward the shore and from its widely opened mouth the form of Jonah plunges, with arms extended to break his fall. In the third scene Jonah reposes under the gourd vine which Jehovah caused to grow and wither again next day as a sign unto him.

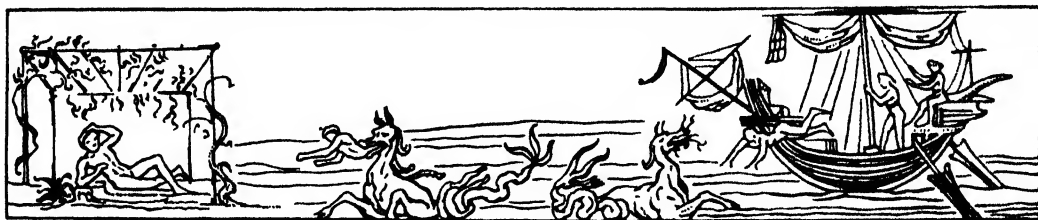


Fig. 5. The story of Jonah, fresco in the Catacomb of Callistus, late 2d century.

the latter, the most frequent are Moses striking the rock from which water gushes, the three children of Israel in the fiery furnace, Noah in the ark welcoming the dove with the sprig of olive, Jonah thrown to the whale and cast up safe on shore, and Daniel in the lions' den. These scenes were obviously chosen as peculiarly fitting for sepulchral use, and it seems equally clear that they did not come directly from the Bible, but rather from early prayers and liturgies for the dead, like a prayer which is still used in the Roman Church, and from which the following verses may serve to illustrate the type: "Deliver, O Lord, the soul of thy servant as thou didst deliver Noah from the deluge. Deliver, O Lord, his soul as thou didst deliver Isaac from sacrifice. Deliver, O Lord, his soul as thou didst free Daniel from the den of lions." And so the prayer continues with the same formula, listing almost all the Old Testament subjects which are

These three closely connected incidents rank among the most popular subjects figured in the catacombs. Not only did they symbolize in general the salvation of the Christian soul, but, more specifically, the death and resurrection of Christ himself; hence, more broadly, they expressed the belief of the individual Christian in the resurrection of the body and life everlasting. For, just as Jonah abode for two days in the belly of the whale and on the third was cast up safe on shore, so did Christ descend to the tomb and on the third day rise again from the dead. But, in addition to this symbolic message expressed in forms entirely Roman and classic, another important feature demands attention, the use by the artist of the continuous method, the so-called narrative style, in which, by the repetition of the figure of Jonah in successive phases of action, his story is simply and graphically told. This vivid narrative style, used so effectively to expound Christian doctrine

throughout the Middle Ages and recently revived in the modern comic strip, provided the Christian artist with an essential means for realizing the chief purpose of his art, that of teaching Christian dogma to a largely illiterate people.

To us of today, as doubtless to the early believers themselves, the scenes of the life and miracles of Christ were endowed with peculiar significance. Appearing first in the catacombs and thereafter of wide appeal is the story of the adoration of the Magi. Approaching from right and left the seated Virgin, who holds the Child, come the wise men of the East with their gifts. And, that no one may mistake their Eastern character, they are clad in Persian garb, with conical hats, flowing capes, and full trousers. The baptism of Christ, on the other hand, is figured with the utmost classic simplicity. John stands nude at the water's edge, extending his hand to Christ, who approaches from the bank, and both are Roman classic figures, youthful and unbearded. Were it not for the dove of the Holy Spirit which appears above, they might well be taken for a

paradise wherein the risen soul praises God for evermore. On good scriptural authority Christ himself was early figured as a lamb, the Lamb of God; and strangely, also, as a fish, often shown together with a basket of rolls, referring both to the Eucharist and to the miracle of the loaves and fishes (Fig. 7). The fish symbol was arrived at in a curiously fortuitous manner. Thus, if one writes in column the Greek words meaning "Jesus Christ of God the Son, our Saviour," and reads in order the initial letter of each, the letters in



Fig. 7. Eucharistic symbol in crypt of the Catacomb of Lucina, middle of 2d century. It not only represents Christ, but alludes also to the miracle of the loaves and fishes.

question form the Greek word *ichthys*, meaning "fish." More important, perhaps, was the representation of Christ the Good Shepherd, a symbolic type which plays an important role not only in the catacombs but also on sculptured sarcophagi and in the mosaics of early churches (Fig. 8). The Good Shepherd, as shown in these works, appears as a simple Roman with youthful classic features, a fair unbearded face often framed in curling locks of hair, and the graceful bodily pose of a young athlete. He is clad in a short tunic



Fig. 6. *Orans in Paradiso*, with inscription reading "Dionysias in Pace," fresco in the Catacomb of St. Soter, end of 3d century.

couple of young Romans about to plunge into a country stream. From the miracles of Christ the scenes most often represented are the multiplication of the loaves and fishes, the transformation of water into wine at the marriage in Cana, the healing of the paralytic and the raising of Lazarus. In each case the style is entirely Roman, while the action, reduced to its lowest terms, is shown with the minimum number of figures. Thus, for example, in the healing of the paralytic is sketched the single figure of a man who bears a couch on his shoulders: "Arise, take up thy bed and walk." Although Christ himself does not appear, the essence of the miracle is unmistakably represented.

A third group of subjects, those of a more abstract symbolic nature, present the idea of heaven, the ultimate beatitude of the soul. Chief among them is the figure of the *Orans in Paradiso* (Fig. 6). Man, woman, or child, as the case may be, the *Orans*, clad in festal garb and with hands uplifted in prayer, stands upright in the midst of a beautiful garden sketchily represented by a few flowering shrubs. This is the



Fig. 8. The Good Shepherd, fresco decoration in ceiling of the Catacomb of Lucina, first half of 3d century.

girded above the knees, and his feet and legs, though sometimes bare, are generally shod and protected by stout leggings. One hand grasps on his chest the legs of a sheep across his shoulders and the other holds his staff, jug, or musical pipes, while to his right and left repose other sheep in a schematic landscape setting. Nothing could have comported better with the spirit of early catacomb art than this symbol, which reveals its strongly classic basis, its essentially Roman vocabulary, and its abstract Oriental content.

Sculpture.—Doubtless because of their profound aversion to graven images, the Christians of the earlier centuries produced almost no sculpture, so that only with the era of peace did wealthy converts begin to use sculptured sarcophagi. And here again, just as in the frescoes, the only feature which distinguished these from pagan works of the same period resides in the symbolic meaning and specifically Christian content of the scenes and persons represented. The so-called Jonah sarcophagus, now in the Lateran Museum, follows almost exactly in iconography and symbolic purpose the subject matter already noted in the frescoes; but also, in order to enforce the doctrine of the resurrection of the body and life everlasting, the artist added the familiar scenes of the raising of Lazarus, of Daniel in the lions' den and of several others whose meanings are more difficult to determine. Several marble statues of the Good Shepherd have been discovered, and a seated figure of St. Hippolytus, found in the catacomb of his name, shows inscribed on his cathedra a list of his works and his computation of the Easter cycle for the years 222-334.

Gold Glasses.—The gold glasses, of which many have been discovered in the catacombs in a more or less fragmentary condition, were blown in the usual way of clear greenish glass and were decorated with figures, portraits, symbols, and even miniature scenes in the form of gold-leaf silhouettes. When the vessel itself had been shaped, fashioned, and allowed to cool, the delicate figures were worked on its bottom or sides in applied gold leaf, and the entire decoration was then protected by a thin outer layer of glass. Although scholars disagree as to when and where the technique of gold-glass originated, the art seems to have fallen almost exclusively into the hands of Christians after the middle of the 3d century. It is, at any rate, only Christian examples that have been found in large numbers, their importance depending less on artistic quality than religious content, although for the most part they merely repeat familiar subjects drawn from the repertoire of the frescoes or the sarcophagi. In certain significant aspects, however, the Christian specimens continued pagan tradition by showing portraits of a married pair or family group, giving their names and often, also, the revealing inscription, *PIE ZESES*, "Drink!—and long life to you!" a Greek toast written in Latin letters. It is hence clear that the cups were made locally and on order for convivial occasions, marriage feasts, and funeral banquets, traditional observances which the Christians inherited from their pagan Roman forebears. And, since they bore not only portraits but also the names of the persons represented, the bottoms of such cups were often pressed into the fresh plaster on the walls of the catacombs to identify the place of their owner's entombment. This custom accounts for the large number of these fragile objects preserved to the present day. Yet the vogue which they enjoyed did not long outlast the end of the 4th century, at which time it seems that the church was obliged to suppress the feasts they served, since the latter obviously did not comport with true Christian sobriety.

Minor Arts.—From the galleries of the catacombs and even from the tombs themselves have come a considerable number of minor objects such as rings, seals, coins and medals, as well as combs and buttons of carved ivory, and even children's toys. Clay lamps are most frequently found, the

majority differing in no respect from those used by the pagans. In the 3d and 4th centuries, however, they were marked with Christian emblems such as the fish, the chrismon, and the Good Shepherd, affording graphic illustration of the extent to which the Christian faith had come to penetrate and sustain domestic life.

Inscriptions.—To give an adequate account of catacomb epigraphy in a brief paragraph is obviously impossible, yet the numerous inscriptions found in the catacombs are of prime scholarly interest because of the light which they throw upon dogma, or upon the conditions of civil and religious life. As to method of execution, they were either carved on slabs or tomb markers, painted on the frescoed walls, or rudely scratched as graffiti on the plaster or tufa. An important distinction to be drawn is that between the original titles and epitaphs, and the later inscriptions in verse with which Pope Damasus and his followers adorned the tombs of saints and martyrs. Most of the very early inscriptions in the catacombs were in Greek, although sometimes written in Latin characters as we have already observed in the gold-glass cups. The early epitaphs are usually very brief, giving the name of the departed, with a short prayer and a symbol such as the fish, anchor, or chrismon, to which are occasionally added the date of burial and age. The most common type of inscription, however, is that accompanying the *Orans* in Fig. 6, "*Dionysas in pace*," "*Dionysas rest in peace*." Especially strong is the testimony of the catacombs to prayers for and to the dead, as appears from a well-known epitaph of the Catacomb of Domitilla, which reads as follows: "Gentianus the faithful, in peace. He lived twenty-one years, eight months and sixteen days. In thy petitions pray for us, because we know thou art with Christ."

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EMERSON H. SWIFT,

Professor of Fine Arts, Columbia University.

CATACOUSTICS, kăt-â-kōōs'tîks, the science which treats of reflected sounds, or that part of acoustics which considers the properties of echoes.

CATAFALQUE, kăt'â-fălq (French from Ital. *catàfalco*, scaffold), a temporary richly decorated structure, usually erected in a church, upon which is placed the coffin or the effigy of an eminent person at his funeral ceremonies. The catafalque was introduced into France in the early centuries of the monarchy. Among famous catafalques was that designed by Italian artists in the nave of San Lorenzo, Florence, to honor Michelangelo; the one erected in the Hôtel des Invalides, Paris, in 1840, for the remains of Napoleon I brought from St. Helena; and that erected under the Arch of Triumph in Paris in 1885, on which the body of Victor Hugo lay in state for several days before the imposing public funeral in the Pantheon.

CATAGENESIS, kăt-â-jên't-sîs (Gr. κατα down, and γένεσις generation), in biology the retrogressive evolution of living species. The

term is used to describe two different orders of phenomena. Primarily it is applied to regression as observed, for example, among parasites which, gradually adapting themselves to parasitic existence, lose part of their organs and are transformed into a digestive and generative sac. Similarly it applies to species forced to continue living in an environment which has become unfavorable to them, as in the case of some insular species. Secondly, the term catagenesis can signify, by opposition to anagenesis (reproduction or regeneration of tissue), the disappearance of certain characteristics no longer useful. Thus the more or less frequent absence of wisdom teeth among civilized people is a catagenetic phenomenon.

CATALAN, a native of Catalonia (q.v.) and certain other parts of northeastern Spain. For the language, see CATALAN LANGUAGE and CATALAN LITERATURE.

CATALAN FORGE is a hearth type furnace for smelting iron ore which originated in Catalonia, Spain, about 1300 A.D. and spread throughout the world. It probably evolved from a stone-lined hole in the ground to a brick-lined hearth.

The hearth, 30 inches square and 3 feet deep, was half filled with a charcoal and iron ore mixture, more charcoal was placed at the back and ore at the front of the hearth. An air blast entering the back of the hearth burned the charcoal, the carbon monoxide thus generated reducing most of the iron oxide in the ore to iron and the charcoal the remainder. Water falling in a tube sucked in air which was trapped in a box below and delivered through the tuyère to the hearth; water escaped near the bottom of the box. That combination of water, tube, and box is called a trompe. The loop (Fr. *loupe*), spongy reduced iron, was not hot enough to melt. While hot, it was lifted from the hearth and hammered into a cake or bar.

It is believed that the Catalan forge was the first large scale smelter, producing up to 350 pounds of iron during a five-hour period.

CATALAN GRAND COMPANY, a name of a troop of mercenary soldiers, called Almúgavars, raised by Roger de Flor (q.v.) about the beginning of the 14th century. After giving his services to Frederick II, king of Sicily, Roger proposed to maintain the soldiers by taking them to the East to fight the Turks, who were desolating the Eastern Empire.

Andronicus II, then emperor, gladly accepted the offered assistance of Roger and submitted to all the conditions imposed. Roger set sail from Messina, Sicily, in 1303, with 26 vessels partly equipped at his own expense. The number of mercenaries which embarked with him is said to have amounted to about 6,000 men of different nations among which were Sicilians, Catalans, and Aragonese. The Catalans, either because they were the most numerous or for some other reason, gave their name to the whole company.

On his arrival at Constantinople, Roger was received with great rejoicings and was elevated to the dignity of grand duke. A bloody affray between the Genoese and the Catalans marked the first period of adventures in Constantinople. Andronicus hastened to get them to cross over into Asia. This they did in the spring of 1304 and in the same year completely defeated the Turks.

They then forced the Turks to raise the siege of Philadelphia, but an attempt to take Magnesia was not so successful. After a long and ineffective siege he recrossed into Europe in 1306, bringing along with him his Catalans, who left behind them everywhere traces of their plunder and violence. When they reached Europe they took up quarters at Gallipoli.

Andronicus, who was by this time very anxious to be rid of his formidable allies, received Roger with great coldness and even obliged him to give up his title of grand duke. But simultaneous incursions of the Turks into Asia compelled Andronicus again to appeal to Roger and his Catalans for assistance. Roger was raised to the dignity of Caesar to appease him for the recent affronts, but this only caused him to be regarded with more jealousy by the Greeks and especially by Michael IX, the son of Andronicus, who was associated with his father in the empire. The result was that before Roger could once more start for Asia, he was invited to Adrianople by Michael, who contrived his assassination and the massacre of his troops, April 4, 1306. The Catalans now turned their arms against the Byzantines, in order to avenge the death of their leader, and defeated them in several battles. Then they passed into Greece and entered the service of the duke of Athens, but shortly afterward turned against him and defeated him in 1311. They then became masters of Attica and established their own dynasty which lasted until its overthrow by the Florentines in 1388. See also GREECE—*History of Byzantine Period: 330–1453* (The Situation in Greece).

CATALAN LANGUAGE. Fundamental Concepts.—Catalan is one of the nine Romance languages, those derived from Latin. Its geographic location in the northeast corner of ancient Hispania has made Catalan a language bridge between the Gallo-Romance and the Ibero-Romance dialects. Catalan was for many years considered a dialect variant of Provençal, and only around 1925 was there unanimity in placing Catalan in the category of an independent neo-Latin language. It should not be imagined that Catalan is a dialect of Castilian or Spanish merely because the latter is the official language of all Spain. There are two opinions as to which of its Romance neighbors Catalan resembles more: one holds that Catalan should be classed with the Gallo-Romances (W. Meyer-Lübke, *Das Katalanische*, 1925); the other, that it be classed with the Ibero-Romances (R. Menéndez Pidal, *Orígenes del español*, 1926). Catalan is a language fundamentally Hispanic in origin, but with the developing Reconquest the territory of this incipient Romance was more oriented towards the north, and consequently it developed many linguistic traits similar to those of Provençal.

The basis of Catalan is, of course, the Latin spoken by the masses and the Roman middle classes. In the different zones that can be outlined in Vulgar Latin, Catalan sometimes coincides with the Hispanic Romances (*cova*, Sp. *cueva*, "cave," Lat. *cova*); other times it coincides with the central portion of Rumania (*parlar*, Sp. *hablar*, "to speak," Lat. *parabolare*); and still others it has forms found in neither neighboring group (*desar*, Sp. *guardar*, "to keep," Lat. *densare*). The Catalan lexicon, in addition to the Vulgar Latin fund, was enriched by many contributors: classical Latin (learned words), Greek (ancient

and medieval words, modern technical terms), pre-Romance languages (words from Iberian, Celtic, Ligurian, Phoenician), Germanic (Latinized Germanic words, proper names), and Arabic (many terms and a great number of toponyms). Following its constitution as a language Catalan has received elements from Provençal, Spanish (and through it, from the American Indian languages), French, Italian, and to a lesser degree English and German.

Catalan is spoken in an area comprising: Catalonia, except the Valley of Arán (where Gascon is spoken); Valencia, excepting some regions in the west; the Balearic Islands; almost all the French department of Pyrénées Orientales; Andorra; the city of Alghero (Sardinia); a strip along the east of the provinces of Huesca, Zaragoza, and Teruel. To the north Catalan is bounded by Provençal and Gascon dialects, and to the west by the surviving forms of Old Aragonese and by Castilian. The total population in the domain of Catalan exceeds 5 million inhabitants: 4,775,000 in Spain; 238,000 outside Spain. In spite of the centuries of decadence, and in spite of the fact that it is not the official language, Catalan has maintained its vitality. This is a very important factor since the modern revival and the great work in purifying and fixing of the literary language would serve nothing if the people, individual speakers of the language, felt it to be foreign to them. Medieval Catalan of the chanceries was used in literature to the exclusion of latent dialectal forms and the latter did not manifest themselves until the 16th century. In the mid-20th century the dialects can be defined as (1) the eastern dialects: central (Barcelona, Girona, Tarragona), Balearic (in the Balearic Islands), Roussillon (in Roussillon, France), Algherian (Sardinia); and (2) the western dialects: Leridan (Lérida), Valencian (Valencia).

Linguistic Features.—**Pronunciation.** Catalan distinguishes the open vowels *e*, *o* as phonemes distinct from the corresponding closed vowels. (Castilian has only open and closed variants of the single phonemes, *e*, *o*.) In the speech of Barcelona unaccented *a* and *e* are pronounced as an indistinct neutral vowel, and unaccented *o* and *u* are pronounced as *u*; but the western dialects distinguish clearly between *a* and *e* and between *o* and *u*. Catalan has the apico-alveolar articulation of the *s*, as in Castilian (and as opposed to the European predorsal *s*). It has a series of palatals based on *x* and *j*; an articulation of *l* with strong velar resonance; and the Old Romance affricates *ts*, *dz*, *tx*, *tj*. In syntactic phonetics, voiceless consonants (except occlusives and liquids) become voiced in word final position and before a following vowel (*els astres* "the stars" is pronounced *elastres*).

Phonetics.—Catalan is distinguished by the absence of spontaneous diphthongization of short Latin vowels: where Castilian has *bien*, *buena*, Catalan has *bé*, *bo* (Lat. *bēne*, *bōnu*); in principle it preserves the original vowels *a*, *i*, *o*, *u*; Vulgar Latin *e*'s produce mixed results, differing according to dialects; the vowels tend to combine with a palatal (the yod) or a velar (the wau) with which they are in contact and close their articulation, thereby reducing the diphthong: Lat. *laicu* gives Cat. *llec* "lay," Lat. *auru* gives or "gold," so that it may be said that there is a vocalic closing due to the effect of the yod or wau. The Catalan consonant system is characterized by the palatalization and assibilation of

consonants in contact with the vowels *e* and *i* (*ciutat* "city," Lat. *civitate*), or in contact with a yod (*acer* "steel," Lat. *aciariu*); by the relaxation of consonants whereby the voiceless become voiced (*nebot* "nephew," Lat. *nepote*), the voiced consonants at times disappear (*suor* "sweat," Lat. *sudore*). This relaxation explains the vocalization of the final (or equivalent to final) consonant into *-u* (*hereu* "heir," Lat. *herede*). In groups of two consonants the first is weakened and at times tends to be assimilated by the second (*neta* "granddaughter," Lat. *nepta*), and at times tends to be converted to a semivowel *u* or *i*; the semivowel thus formed then either combines with the preceding vowel or is absorbed by it (*om* "elm," Lat. *ulmu*, which presupposes in intermediate form **oum*; *fet* "deed," Lat. *factu*, which presupposes **fait*), or it may palatalize the second consonant of the group (*cunyat* "brother-in-law," Lat. *cognatu*, which presupposes **coinat*).

Morphology.—The derivation of the words from Latin is based on the Latin accusative forms, although there are unquestionably some words derived from other Latin cases, especially from the nominative (*res* "thing"). Latin adjectives with only one form tend to take on a specific ending for the feminine, generalized in a few instances (*fort*, *forta* "strong," Lat. *forte*), but with greater extension in the popular speech (*fàcil* "easy" has the popular feminine form *fàcila*, not recognized as correct). The article normally comes from Lat. *ille* (*el*, *la*), but in preliterary Catalan there existed, with wide usage, the article derived from Lat. *ipse* (*es*, *sa*), still used in the Balearic Islands and on the Costa Brava in Catalonia, and can also be found fossilized in toponyms in much of Catalonia (*Collsacabra*, *St. Joan Despi*). The four Latin conjugations have been preserved in Catalan, although in different proportions: *cantare* > *cantar*, *habēre* > *haver*, *perdere* > *perdre*, *venire* > *venir*. Characteristic of the Catalan perfect tense is its almost universal replacement by a periphrasis with the present of the verb *anar* "to go" (*vaig* "I go," *vas* "you go"); *vaig cantar* means "I sang" (the same as *canti*), *vas cantar* "you sang" (as *cantares*).

Syntax.—Catalan constructs the determinatives of quantity with a partitive: *molt de temps* "much time" (compared to Sp. *mucho tiempo*). Catalan admits some adverbs for the expression of pronominal relations, such as *hi* "in it" (Lat. *ibi*) and *en* "of it" (Lat. *inde*). It distinguishes, as does Spanish, between the two intransitive copulative verbs *ser* and *estar*, but the languages do not coincide in the distinction; for example, temporary state is expressed in Catalan with *ser* and in Spanish with *estar*. In opposition to the use, waxing since the Middle Ages, of the subjunctive mood in Spanish, Catalan prefers other expressions, such as the future (*quan tornaràs* "when you return," Sp. *cuando vuelvas*), the imperfect (*si tu volies* "if you wanted," Sp. *si tu quisieras*), the conditional (*no t'ho hauria dit* "I should not have told you," Sp. *no te lo hubiera dicho*). The past participle in compound tenses, invariable in Spanish, agrees in Catalan with the direct object: *l'ha conegut* "he has known him," *l'ha coneguda* "he has known her," compared to Spanish *lo* or *la* *ha conocido*.

Modern Catalan Philology.—This work began with the endeavors of A. Alcover and his *Bolletí*

* The asterisk indicates a hypothetical intermediate form.

del *Diccionari de la Llengua Catalana* (since 1901), directed toward the collection of material to comprise the *Diccionari Català-Valencià-Balear*, which began to be published in Majorca in 1930. Impetus was further given to the study of Catalan by the *Primer Congrès Internacional de la Llengua Catalana* in 1906, and by the interest on the part of many publishers to print editions of medieval Catalan texts. The Institut d'Estudis Catalans, founded in 1907, fixed Catalan orthography in 1913, and such important works were undertaken as the *Butlletí de Dialectologia Catalana* (since 1913) and the *Atlas Lingüístic de Catalunya* (1923) by A. Griaer, and there was an active personal and scientific participation in international Romance studies. Almost 50 years after the Congress of 1906, Barcelona was the scene of the Seventh International Congress of Romance Linguistics (April 1953), which saw a recapitulation of more than half a century of Catalan philology, focused the attention of the more than 250 delegates on the problems of Catalan and marked a new stage in recent studies.

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A. BADIA MARGARIT,
Professor of the University of Barcelona.

CATALAN LITERATURE. Literature in the Catalan language has two periods of development: the first extends from the beginning of the 13th century to the end of the 15th, and the second begins around 1833. Collaborators in this literature are not only writers born in Catalonia but also those from the old kingdoms of Majorca and Valencia and the province of Roussillon (the latter now a part of France), regions in which Catalan is the vernacular. A collection of sermons, *Homilies d'Organyà*, of the beginning of the 13th century, is considered the oldest literary text in Catalan, although its principal value is linguistic. In that period Provençal, another Romance language and a neighbor of Catalan, was studiously cultivated in Catalonia by learned or aristocratic Catalan poets, owing to the frequent historical and political relations the counts of Barcelona and the kings of Aragon had with the lands of southern France. The court of Barcelona received many Provençal troubadours and as a consequence the Catalan courtiers wrote their verses in Provençal, among them being King Alfonso II of Aragon (1152-1196), whose dominions extended north of the Pyrenees. Among the troubadours born in Catalonia should be mentioned the cynical and brutal Guilhem de Berguedan, the refined and delicate Pons de la Guardia, and Guilhem de Cabestanh (12th century), and the prolific and varied Guilhem de Cervera, called in troubadour fashion Cerverí (13th century). This poetry exercised a strong influence in the learned Catalan poets of the 14th century, who followed faithfully the themes, the style, and in part the language, of the classic Provençal troubadours.

Medieval Period.—Genuinely Catalan prose reached its greatest perfection in the extensive work of that important figure, the Majorcan Raymond Lully (Cat. Ramón Llull, Lat. Raimundus

Lullus, 1233-1315). Some 250 authentic works of Lully have been preserved in which are expounded his ideas of philosophy and his missionary zeal. From the point of view exclusively literary he is a true artist of Catalan prose, in which language he wrote books on science and philosophy at a time when these subjects were normally treated in Latin. His principal works are his lengthy *Libre de contemplació . . .* (*Book of Contemplation . . .*), an impressive climax to his mystic experiences, his Utopian novels *Libre de meravelles* (*Book of Marvels*) and *Blanquerna*, and his collection of short prayers called *Libre d'Amich e d'Amat* (*Book of the Lover and the Beloved*), an ejaculatory of Christian lyricism. In his verse Lully used a language closer to Provençal than to Catalan, as can be seen in *Lo Desconhort* (*Despair*), a poem written in a moment of acute pessimism, and in the *Plant de Nostra Dona . . .* (*Lament of Our Lady . . .*), a sort of *Stabat Mater*. A contemporary of Raymond Lully was the famous doctor and visionary from Valencia, Arnau de Vilanova (Arnaud de Villeneuve, c.1238-1311), who, although generally using Latin, wrote brief treatises in Catalan in the form of disputes or debates, of which four have been preserved.

Historiography constitutes the most important element of Catalan prose of the 14th century. Four great chronicles stand out: the oldest of these is the *Libre dels feyts* (*Book of Deeds*), in the redaction of which King James I of Aragon (1208-1276) took a leading role (the extant text is a later revision dated between 1313 and 1327). This chronicle narrates principally the conquests of Majorca and Valencia and is the prosification of epic poems now lost. Bernat Desclot wrote between 1285 and 1295 a *Crònica* devoted for the most part to the deeds of King Pedro III the Great; it is strongly dramatic in the description of early events in the expansion of Aragon through the south of Italy, and especially in describing the war of Catalonia against the invading French. The *Crònica* (written in 1325) of Ramon Muntaner (1265-1336) is unforgettable for its familiar and colorful style, as it narrates with detail and emotion the Catalan expedition to Greece and Asia Minor, the chronicler having been one of the leaders of the expedition. The last of the four chief chronicles is that written by King Pedro IV the Ceremonious (with several collaborators) and which has a more political character; it was finished in 1388, a period in which Catalan prose was being renewed thanks to Humanism.

An excellent narrator and the writer of pleasant and attractive prose is the Franciscan Francesch Eiximenis (1340-1409), author of *Lo Chrestia*, a monumental encyclopedia similar to the medieval *Summae*, and of a didactic work, the *Libre de les dones* (*Book of Women*), a very colorful work abounding in odd bits of information. The chanceries of the kings of Aragon (counts of Barcelona), thoroughly organized by the mentioned Pedro IV, formed a sound intellectual center in which the royal secretaries of the end of the 14th century occupied themselves with the Humanistic and Ciceronian editing of Latin documents. This style immediately was adapted to Catalan documents, thereby giving to the prose an elegant Renaissance form. One such notable royal secretary was Bernat Metge (1350-1413) of Barcelona, who was much influenced by the Latin works of Petrarch and Boccaccio. In his

Lo somni (*The Dream*), a treatise written in 1398, Bernat Metge incorporated the new ideas of the Italian Renaissance and at the same time gave a Humanistic cultured and measured elegance to Catalan prose. His followers were a large number of Humanists, strongly influenced by Italy, most of whom were translators of the Latin classics. Worthy of note towards the end of the 15th century is the prose of the Valencian Joan Rois de Corella (1430-1500), an elegant adaptor of Ovidian fables in an excessively rhetorical style.

In the lyric of the end of the 14th century the prominent poets are Andreu Febrer and Gilabert de Pròxita, still influenced by Provençal tastes. Jordi de Sant Jordi (beginning of 15th century) was a courtly poet of delicacy who united in his work the preciousness of Arnaut Daniel and the tenderness of Petrarch, imitating each at times. The best of the Catalan lyric poets was the Valencian Ausiàs March (1397-1459), falconer to King Alfonso V the Magnanimous (Alfonso I of Naples). Ausiàs March, writing in a Catalan free from Provençalisms, analyzed scholastically his fancies and his passions in a personal and vigorous style. He put poetry at the service of a profound introspection, tortured and obsessive, which secures for him a position of singular importance in the medieval Romance lyric. The principal qualities of his style are his many comparisons (frequently referring to the sea) and the proud, high-sounding tone that he acquires on occasion. The 15th century is brightened by a multitude of Catalan poets, at times influenced by the Italian or by the courtly French lyric; among these are Pere Torroella (also a cultivator of Castilian poetry under the name of Pedro Torrellas) and the refined Rois de Corella, already mentioned as a prose writer.

The Catalan novel began with versions of French prose texts concerning the Holy Grail and Tristan, novels of chivalry. In the mid-15th century two important novels of chivalry of Catalan origin appeared: the anonymous *Curial e Güelfa* revealing French and Italian influences, and *Tirant lo Blanch*. The latter was written by the Valencian knight Johanot Martorell and is one of the most interesting of medieval novels for its realism, its naturalness, and its exactitude in the creation of atmosphere, types, and situations. This novel was known and even imitated to a degree by Ariosto and Cervantes. Within the classification of the novel falls the satiric treatise by the renegade Majorcan Anselm Turmeda entitled *Disputa de l'Ase* (*Dispute of the Ass*) whose original text, written in 1417, has been lost, but which has been preserved through a French version printed in 1544. Although written in narrative verse *Spill* (*Mirror*), 1460, the work of the Valencian Jaume Roig (d. 1478), is really a novel in content: the protagonist, a hapless young man, relates his adventures with bandits and his marital misfortunes; in certain respects *Spill* is a forerunner of the Castilian picaresque novel.

Catalan oratory had many cultivators among the parliamentarians, and outstanding in this field were the discourses delivered by King Martín I. San Vicente Ferrer (1350-1419) was an impassioned and popular orator, making frequent references to daily life and customs and not disdaining to use the language of the people. (The Italian orator Bernardino of Siena openly imitated Ferrer.) A solemn and learned orator was Felip

de Malla, of whose works have been preserved some speeches and a rhetorical, allegorical treatise called *Memorial del peccador remut* (*Memorial of the Redeemed Sinner*).

Decadence and Revival.—From the beginning of the 16th century until the middle of the 19th Catalan letters languished, due chiefly to the disappearance of the court, the real nucleus of medieval Catalan literature, which was essentially courtly. Catalan and Valencian authors increasingly wrote in Castilian, attracted by the splendor of Golden Age Spanish. Notwithstanding, Catalan continued as the official language in Catalonia with no governmental interference until 1714, when Philip V of Spain, grandson of Louis XIV, imposed absolutism of the French type. In the following century Romanticism produced a revival of Catalan literature (called *Renaixença*, which began with *Oda a la Pàtria* (1833), a perfect ode composed in Madrid by the erudite Buenaventura, Carlos Aribau. There immediately followed a series of attempts directed toward reviving the ancient Catalan literature and restoring to the language a literary dignity. In this effort Catalan writers received the collaboration of Majorcans, to a lesser degree of Valencians, and sporadically of Roussillon writers. Poetry contests, called *Jocs Florals*, initiated in 1859 and still held throughout Catalonia, gave great popularity to the *Renaixença*. The most important figure of later 19th century Catalan literature was Jacinto Verdaguer (1845-1902), a poet of fecund and overflowing imagination as much in his epic, exemplified by his poems *L'Atlàntida* (in which he joined classic mythology to the discovery of America) and the *Canigó* (a medieval legend of the Pyrenees), as in his mystic Franciscan lyric. The poet Joan Maragall (1860-1911) displayed a sincere accent of intimacy in committing his delights, his sorrow, and his impressions to a suitable elevated lyric. The Majorcan poets, especially Joan Alcover (d. 1926) and Miquel Costa y Llobera, gave to Catalan poetry of the beginning of the 20th century an exquisite elegance.

The Catalan novel of the end of the 19th century and early 20th is represented by the names Narcís Oller, Joaquim Ruyra, Víctor Català (pseudonym of the authoress Catalina Albert i Paradís), and especially Eugeni d'Ors, author of *La ben plantada*. A younger generation includes the novelists Miquel Llor, Sebastià Juan Arbó, and the short-story writers J. E. Martínez Ferrando and Salvador Espriu. The theater suffered from overuse of the popular tone and routine ruralism. Nevertheless, worthy of note are Angel Guimerà (1849-1924), whose drama, *Terra baixa* (*Lowlands*), was an international success, and Josep Maria de Sagarra (b. 1894), important also as a lyric and epic poet and author of an excellent translation in verse of the *Divine Comedy*.

Perhaps one of the most significant events in the Catalan literature of the third decade of the 20th century was the surrealist manifesto called the *Full groc* (*Yellow Leaf*), one of whose signers was the painter Salvador Dalí. Published in 1928, it introduced the ideas of André Breton and was directed against the reactionary popularism of some Catalan authors of that period.

A rich personality characterizes Carles Riba (b. 1893), who as a poet, beginning with his *Estances*, renewed themes and images and carried the language to a lofty and serene dignity, values he maintained in his later books, among them

Salvatge cor (Savage Heart) published in 1952. Riba has exercised a decisive influence over younger generations of poets. Professor of Greek, Riba has made fine translations of the *Odyssey* (in long verse imitating the Homeric hexameter) as well as the work of Aeschylus, Sophocles, of Plutarch, and others. It should be realized that the most cultivated expression of modern Catalan prose is to be found in the translations and adaptations, nearly all of them excellent, of Greek and Latin authors that are published by the Fundació Bernat Metge, which numbers among its collaborators some of the finest Hellenists and Latinists.

The originality of the poetry of Josep V. Foix (b. 1894) is extraordinary. He has managed to join the more positive results of surrealism with a traditional Catalan inspiration (an echo of Raymond Lully and Ausiàs March), in a full form which is as well virile and bold and in an expression disturbingly metaphoric or consciously automatic. His book *Les irreals omegas (The Unreal Omegas)*, published in 1949, is one of the most important in the Catalan lyric of the first half of the 20th century. Other outstanding poets of this half century are Josep Carner, "Guerau de Liost" (pseudonym of Jaume Bofill i Mates), Joan Salvat Papasseit, Josep Maria López-Picó, Marià Manent, Tomàs Garcés, Sebastià Sánchez Juan, and the Majorcans Maria Antonia Salvà and Llorenç Ribet (the last named also an excellent writer of prose and fine translator of Latin authors).

The creation of multiple literary awards for the production of books in Catalan (City of Barcelona Prize for Catalan Poetry, established in 1951; Johanot Martorell Prize for the novel, in 1949), the legally sanctioned teaching of Catalan philology and literature in Spanish universities (laws of 1944 and 1952), the great increase in the editorial output in Catalan since 1947 (part of which is dedicated to the publication of medieval Catalan authors), these facts indicate that in the mid-20th century there has been a new resurgence of this literature in Catalonia proper and in Majorca, and, to a lesser degree, in Valencia; while in Roussillon (France) the literary production is scant and practically nothing is being published.

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MARTÍN DE RIQUER,

Professor of the University of Barcelona.

CATALANI, kă-tă-lă'ně, **Alfredo**, Italian composer: b. Lucca, Italy, July 19, 1854; d. Milan, Italy, Aug. 7, 1893. He was graduated at the Paris Conservatory and settled in Milan, where he achieved fame with brilliant operas, especially *Dejanice*, *Loreley*, and *Wally*.

CATALANI, kă-tă-lă'ně, **Angelica**, Italian singer: b. Senigallia, Italy, May 10, 1780 (although several other years are given); d. Paris, France, June 12, 1849. At the age of 12 she was sent to the convent of Santa Lucia at Gubbio, where her voice commanded attention. At 16 she was compelled by family misfortunes to turn her talents to account and made her first appearance on the stage at Venice. She continued with phenomenal success in leading soprano roles in the opera houses of Milan, Florence, Rome, Naples.

Madrid, Paris, London and the principal towns of Great Britain, in all of which her success and profits were immense. In 1814 she returned to Paris to take the management of the Italian opera there, but sustained thereby severe pecuniary losses from the injudicious interference of her husband, Valabrégue, formerly a captain in the French Army. On Napoleon's return in 1815 she was obliged to resign the direction of the opera, but resumed it again on the second restoration. In 1818 she again resigned the direction of the opera and subsequently made repeated professional tours through the Continent and Great Britain until 1828. In 1830 she retired from public life to a villa in the neighborhood of Florence; here she resided with her family and gave instruction to girls who manifested indications of local talent. She was a woman of majestic appearance and her voice displayed a wonderful degree of power, flexibility, and compass. She rather astonished and overpowered an audience by her marvelous execution rather than touching or subduing their hearts.

CATALAUNIAN PLAIN, the ancient name for the wide plain south of Châlons-sur-Marne, France, famous as the field where Aëtius, the Roman general, and Theodoric I, king of the Visigoths, gained a complete victory over Attila and the Huns in 451 A.D.

CATALCA, chă-täl-jä', or **CHATALJA**, town, Turkey, in Europe, 27 miles northwest of Istanbul. Cement and glass are manufactured, and it is famous for its watermelons. Here the Turks stopped the Bulgarian advance on Istanbul in the Balkan War in November 1912. As a result of the Treaty of Sèvres in 1920, Catalca marks the boundary of European Turkey and is therefore a center of heavy fortifications. Pop. (1950) 22,141.

CATALDI, kă-täl'dě, **Pietro Antonio**, Italian mathematician: b. Bologna, April 15, 1552; d. there, Feb. 11, 1626. He began his mathematical studies at the Academy of Design in Florence, was professor of mathematics at Perugia in 1572 and at Bologna in 1584. He is chiefly known as a pioneer in the use of continued fractions, the common form of which he invented (1613) and employed in the extraction of square roots. However, his method is more novel than practical and is far inferior to that of Cardan. He published more than 30 works on mathematics of which the most important is *Trattato del modo brevissimo di trovare la radice quadra delli numeri* . . . (Bologna 1613).

CATALDUS, Saint, the second bishop and patron saint of Taranto, Italy. He lived in the 6th century.

CATALEPSY, kăt'ă-lěp-sī, in medicine and psychology, a trance-like, morbid state of consciousness in which there is a loss of voluntary muscular control and a peculiar plastic rigidity of the muscles, which retain any position in which they are placed for an indefinite time. Artificially it can be induced by hypnotism; but frequently it is a symptom of hysteria (q.v.), dementia praecox (q.v.), catatonia (q.v.), and stuporous melancholia—all of which have much in common, being affections superimposed on the hysterical nervous organization, a type of make-up of a character, whose main features

are assuming a definite recognition by students of the functions of the nervous system. The normal functions of respiration, digestion and circulation continue. Prolonged cases demand forced feeding. Between attacks cold baths, tonics and various remedies are recommended. An emetic or a pinch of snuff may sometimes avert an attack. The disease still demands investigation, as its immediate cause is not known.

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CATALONIA, kăt-ă-lôn'yă; -lō'nī-ă (Spanish CATALUÑA, kă-tă-lōō'nyă; Catalan CATALUNYA, -lōō'nyă), a region of Spain, at one time a principality. Covering 12,431 square miles, and bounded on the east by the Mediterranean Sea, on the north by France, on the west by Aragon, and on the south by Valencia, it comprises the four provinces of Barcelona, Tarragona, Lérida, and Gerona. The 240-mile coastline on the Mediterranean has good harbors at its former capital, Barcelona (q.v.), and at Rosas, Palamós, Tarragona, and San Carlos de la Rápita. Other urban centers are Gerona, Mataró, Vich, Manresa, Sabadell, Tarrasa, Reus, and Tortosa.

Physiography.—The terrain is in general rugged. A spur of the Pyrenees extends through the region and in the northern part several peaks exceed 9,500 feet and form alpine-type valleys in which important rivers have their sources. In the northwest corner of the region is the *Valle de Arán* where the Garonne River has its source; in the center of the Pyrenean section is the Andorra valley and adjoining it, the Cerdaña, traversed by the Segre River. The Pyrenees descend to *Coll de Perthus*, the best of the passes in the chain, and meet the coast at Cape Creus. From the Pyrenees many minor chains descend to the south, such as Cadí, Montseny, Gabarras, Montsech, Montserrat, Llena, Montsant, and Prades, forming fertile valleys and connecting in the south with the Iberian mountain system. A plain opens to the northeast—the Ampurdán. In the southwest the tertiary basin of Lérida forms another plain which is very dry and linked geologically with Aragon.

Aside from the Ebro River—navigable in the lower part of its course—which receives the waters of the Spanish Pyrenees, the chief rivers in Catalonia are the Segre, the most important affluent of the Ebro, with its own affluents, the Noguera Pallaresa and the Noguera Ribagorçana; the Fluvià; the Ter; the Llobregat; and the Froncoli. Some form deltas, the largest being located in the mouth of the Ebro.

Along the Mediterranean coast southward, the peninsula of Cape Creus, its most eastern point, is followed by the Gulf of Rosas and Cape Bagur. Further south the magnificent rocky *costa brava*, leads to a succession of beaches and cliffs which extend to the delta of the Ebro River.

Agriculture and Industry.—The region of Catalonia is rich in agricultural products. In the mountainous areas cattle are raised and in the drier parts, goats and sheep. Cultivation is varied: grain, vine and olive fields cover a great part of the country and in the swampy zones of the deltas rice is grown. In the last hundred

years many industries have been developed. Chief among these are mining (iron, coal, potash, salt), metallurgy (see CATALAN FURNACE), paper mills, and in particular, textiles (cotton and wool). Because of its agricultural and industrial richness, Catalonia has become the first region of Spain. The Catalonians have been renowned as good traders throughout their history, and in the present century, they have developed a flourishing mercantile life.

History.—Through the centuries Catalonia has maintained a strong regional unity and its own language (see CATALAN LANGUAGE; CATALAN LITERATURE). Paleolithic man left his traces here in his migrations between glacial Europe and Africa and the fossil jaw of Bañolas is evidence of the early presence of Neanderthal man. The race which still forms the ethnic substratum of Spain arrived here in the Paleolithic period. During the Neolithic period invasions from the south brought people with new inventions (agriculture, pottery, metallurgy) from the Nile Valley, and from the north, people of eastern origin, who settled in the Pyrenees, becoming a pastoral race with a culture not wholly forgotten today.

The first Indo-Europeans arrived in the region about 1000 B.C. and two centuries later Celtic tribes intermixed with the indigenous population. Although it is doubtful whether the Phoenicians ever visited the Catalonian coast, it is probable that the Greeks (Rhodians) were early settlers. In the 6th century B.C., Phoenicians from Massalia (Marseille) founded a colony in the Gulf of Rosas, which they called Emporion (market). The site of Emporion has some of the most impressive archeological remains of the Greek settlements in the west, and its name survives in the name of the district of Ampurdán.

The Carthaginians under Hannibal attempted to master this region on their way to Italy; but a Roman army debarked at Emporion in 218 B.C. and after a prolonged struggle under Scipio succeeded in expelling the invaders in 206 B.C. In this war the native Iberians assisted the Romans against the Carthaginians, but subsequently fought for their independence from Rome until they were finally subjugated by Cato the Elder in 196 B.C. The country was soon Romanized and became prosperous. Roman authors describe the peoples of Catalonia as consisting of the *Ilergaones* in the south, the *Ilergetes* in the Segre plain, the *Cosetani* in Tarragona, the *Indigetes* in the Ampurdán, the *Ceretani* in the Pyrenees, and the *Ausetani*, *Laetani*, and *Lacetani* in the center. Tarraco (Tarragona) was the capital of the most important province of Roman Spain and many evidences of the Roman occupation still survive (temples, circus, theater, amphitheater, and aqueducts). Barcino (Barcelona) did not become important until after the 1st century A.D.

The decline of the Roman Empire and finally the invasion of the Visigoths put a check on the prosperity of the country. Barcelona became the capital of the Visigothic king, Ataulphus, who was murdered there in 415 A.D. Subsequently the Visigothic power passed to Toledo, and Catalonia preserved a Roman tradition until the Arab invasion in the early 8th century. Overrunning all but a few Pyrenean valleys, the Arabs moved across the Pyrenees into France, but in the last years of the century, the forces of Christianity liberated the Pyrenean region,

and, with the help of Charlemagne, the Saracens were driven out from Gerona and Barcelona.

After the formation of the *Marca Hispanica*, the Carolingian kings favored the independence of the counts of the *Marca*, and by the 12th century the counts of Barcelona had extended their holdings north of the Pyrenees. In 1137 Catalonia and Aragon were united by the marriage of Ramon Berenguer IV to Petronilla, daughter of the king of Aragon, thus further expanding the Catalonian power which was only curtailed north of the Pyrenees by the Battle of Muret in 1213.

The next two centuries were the most glorious for Catalonia; after many conflicts with the French kings as well as with the popes, both Sicily and Sardinia were annexed to the realm; Catalan knights invaded and ruled Athens and other Greek territories (see CATALAN GRAND COMPANY); and Naples came under the control of a Catalan dynasty. With the end of the Middle Ages, however, the opening of new trade routes caused Mediterranean trade to decline, and Catalonia to lose its dominant position as a trading center. The Aragon crown passed to a Castilian branch in 1410 and, after the marriage of Ferdinand of Aragon and Isabel of Castile in 1474, a united Spain soon developed imperial designs in America. The political and economic decadence of Catalonia began at this time.

In 1640, during the reign of Philip IV, Catalonia revolted with the help of King Louis XIII of France. During the reign of Louis XIV, by terms of the Treaty of the Pyrenees (1659), Roussillon was detached and incorporated in the kingdom of France. In the War of the Spanish Succession, it took a stand against Philip V and after a fierce resistance, Barcelona was captured (1714) and all the privileges of home government were suppressed.

During the 18th century Catalonia developed economically and became in time the richest of the Spanish regions. It fought gallantly in the wars against Napoleon (Siege of Gerona, 1808) and in the numerous internal conflicts during the 19th century.

In the 20th century, anarchistic and national movements developed side by side. Agitation for home rule led to the establishment of an autonomous government in 1932, and two years later an unsuccessful revolution was spurred by extremists. During the civil war of 1936–1939 Catalonia suffered severely, being for the most part on the republican side. In February 1939 Catalonia was reincorporated in united Spain by General Franco's army which included many Catalan contingents. Pop. (1950) 3,240,313.

LUIS PERICOT.

CATALPA, ká-tál'pá, a genus of trees of the family Bignoniaceae, consisting of about 10 species in North America and Asia. They have large, entire or lobed leaves, large panicles of showy white, yellow or pink flowers, and fruit of long, slender, cylindrical pods. *C. catalpa*, the common catalpa or Indian bean, is a native of the southern United States. *C. speciosa*, a similar species, the western catalpa, ranges from Illinois and Indiana to Louisiana and Mississippi.

The wood of these two species is coarse-grained and soft but very durable in the ground, consequently it is much valued for fence posts and railroad ties. These species and some of the Asiatic ones are very widely used as shade trees.

CATALYSIS, or **CATALYTIC ACTION** (Gr. *Katalyein*, to dissolve) an acceleration of the rate of a chemical action due to the pressure of a small quantity of a substance (the catalyst) which remains unchanged at the end of the reaction. For example, cane sugar is inverted (changed into a mixture of dextrose and levulose) in the presence of acids with a velocity that increased with the strength of the acid. This phenomenon is called catalysis, and the acid is said to be a catalyst. Water, which delays the reaction, is said to be a negative catalyst. Again, it is possible by the formation of an arc under water to obtain ultramicroscopic suspensions of many of the metals, such as gold, silver or platinum. These suspensions have the remarkable property of decomposing hydrogen peroxide very rapidly into water and oxygen, while they themselves remain unchanged.

A similar action is shown by certain organic substances, the enzymes. In the case both of the enzymes and of the ultramicroscopic colloidal metallic suspensions, the catalytic action is immensely diminished by the presence of very slight quantities of certain poisonous substances such as hydrocyanic acid or hydrogen sulphide. Another interesting example of catalysis is the action of platinum—black or sulphur dioxide and oxygen, which unite in its presence to form sulphur trioxide. Water vapor is often a catalytic agent; dry ammonia vapor and dry hydrochloric acid will not unite. This example illustrates the fact that catalytic agents accelerate both halves of a reversible reaction, for dry ammonium chloride can be vaporized without dissociating into ammonia and hydrochloric acid.

Catalysis is an extremely common phenomenon in chemistry. Its nature is not well understood; it is agreed that in certain reactions which appear catalytic the "catalyser" enters into the reaction and is ultimately regenerated, but this explanation does not cover all the cases found. In the case of platinum black, which acts as a catalyser in many reactions, Faraday considered that the action was due to the approximation of the molecules of absorbed gases. This case, however, has also been explained as due to the formation of intermediate products into which platinum enters. See also CHEMISTRY—*Catalysts*; ENZYMES.

CATAMARAN, kät-à-mà-rän', a kind of raft used in the East Indies, Brazil, and elsewhere. Those of the island of Ceylon, of Madras, and other parts of the Indian coast are formed of three logs. These are secured together by means of three spreaders and cross lashings through small holes. The center log is much the largest, is pointed at the fore end, and above it are lashed the two others to form a hollow for the crew and cargo, the center log acting as keel.

The name is also applied to any double-hulled craft, many of which have been built for experimental and recreational purposes.

CATAMARCA, kät-à-mär'ká, province, Argentina, a mountainous region in the Andes covering 45,829 square miles, next to the Chilean border. A salt desert. *Salar de Antofalla*, extends about 100 miles along the western foot of Sierra de Calalaste, at an altitude of 11,350 feet. The main rivers are the Santa María, the Belén, and the Colorado, and since every valley has its

mountain stream, the whole province is well watered. Most of the smaller streams are dry in the summer, but overflow in the winter. There are also a number of salt lakes. The soil is fertile, producing large crops of maize and wheat and supporting large numbers of livestock, especially goats. The vine is also cultivated and yields wine and spirits which bear a high name in the surrounding countries. The principal exports are beasts of burden, horned cattle and hides and goatskins, raw or tanned. The principal mineral is iron, but gold, silver, and lead are also found. The capital is Catamarca. Pop. (1943) 162,115, chiefly of Indian extraction, with a considerable mixture of Spaniards.

CATAMARCA, Argentina, the capital of the province of Catamarca, situated on the Valle River, 82 miles northeast of La Rioja and about 250 miles northwest of Cordoba. It is connected by rail with La Rioja and all the chief towns of the republic. It is regularly and moderately well built and contains a fine town hall, a Franciscan monastery, a national college, and a normal school for women. There are considerable imports of European goods and the place is the center of distribution for a flourishing district. Dried figs, wines, brandy, and cotton are the principal articles of export, together with the curious form of embroidery for which the women are celebrated. The city is a mining and agricultural center. It was founded in 1683. Pop. 22,000.

CATAMOUNT, a short form of the phrase "cat of the mountain," frequently found in the older books about America and still occasionally used as a name for the lynx of the eastern United States, and sometimes for the puma, or panther, once common in New England. The term is so indefinite that it is well that it has fallen into disuse.

CATANDUANES, kă-tăn-dwă'nās, island, Philippine Republic, lying northeast of the province of Albay, Luzon, with which it was administratively connected as a subprovince until organized as the republic's 50th province (1947). Its length is 44 miles north and south; width, 29 miles at the southern end; area, 704 square miles. The mountain system consists of three ranges that radiate from Mount Cantilamo near the center of the island; the rest of the surface is irregular, with low hills. The most important rivers are the Oco and the Bató or Cabugao; there are also a number of smaller rivers and the island is well watered. Its soil is fertile, and rice, cotton, corn, and hemp are raised; indigo and coconuts are exported. Gold is found in the gravel beds of some of the rivers. The capital and largest town is Virac (pop. 22,000). The governor and one congressman are elected by the people. Pop. 120,000.

CATANIA, kă-tăn'ya, (ancient CATANA), city, Italy, in the province of Catania, Sicily, on the borders of the valley of Noto. It is the see of a bishop, the suffragan of Monreale, 47 miles south-southwest of Messina, 85 east-southeast of Palermo. It is situated on a gulf of the Mediterranean, at the foot of Mount Etna. This city has been repeatedly visited by violent earthquakes, and partially laid in ruins by lava from eruptions of Mount Etna. The most disastrous eruption

was that of 1669, by which many of the antiquities of Catania were overwhelmed, and the worst earthquake was that of 1693 when 18,000 people were destroyed. Although again greatly injured by the earthquake of 1783, Catania is now reviving with great splendor and has much more the features of a metropolis than Palermo. The principal streets are wide and well paved with lava. Most of the edifices have an air of magnificence unknown in other parts of the island, and the town has a title to rank among the elegant cities of Europe. An obelisk of red granite, placed on the back of an antique elephant of touchstone, stands in the center of the great square, which is formed by the town hall, seminary, and cathedral. The cathedral, a fine building, was founded in 1091 by Count Roger, but required to be mostly rebuilt after the earthquake of 1693. It is dedicated to Saint Agatha, the patroness of the city. The suppressed Benedictine monastery of Saint Nicholas, comprising a church (with splendid organ), library, museum and other extensive buildings, was long celebrated for wealth and splendor. The university, founded about 1444, has about 1,200 students, a school of pharmacy, a library of over 130,000 volumes and a fine collection of shells. The ruins of the amphitheater, which was more extensive than the Coliseum at Rome, are still to be seen, as are also the remains of the theater, baths, aqueducts, sepulchral chambers, hippodrome, and several temples. The industries include the manufacture of silk, linen, and cotton goods, and objects in lava, wood, marble, and Sicilian amber, and the mining of sulphur. The harbor was formerly a good one, but by the eruption of 1669 its entrance was almost entirely choked up, and it is only in recent times that it has been improved, a considerable amount of money having been spent on it. The trade of Catania is of some importance, the principal export being sulphur, next to which come oranges and lemons, almonds and other fruits and wine. Cereals, textiles, and other manufactures are the chief imports. The exports have an average annual value of about \$5,000,000. A circular railway runs from Catania round the base of Mount Etna. The classic Catana was founded by Greeks from Chalcis about 729 B.C. and soon became prosperous. It was the Athenian headquarters in the war between Athens and Syracuse 432 B.C. It flourished under the Romans, by whom it was taken in 263 B.C. It was plundered by the Saracens and fortified by the Normans and, in 1169 A.D., almost destroyed by an earthquake. It was restored in 1232 and fortified by Frederick II, and again flourished for four centuries until the great earthquake and eruption of 1669. Pop. (1936) 244,972.

CATANZARO, kă-tăn-dzā'rō, (ancient CATACIUM), city, Italy, capital of the southern province of the same name, on a height, eight miles from the Gulf of Squillace. It suffered severely from the great earthquake of 1783, but is still a place of some importance, defended by a citadel, and containing a cathedral and various other churches, an academy of sciences, one of the four great civil courts of the kingdom, a lyceum, and three hospitals. The climate being cool and healthful in summer, many wealthy families reside here. The manufactures consist chiefly of silk and velvet,

and there is some trade in wheat, wine, and oil, Pop. (1931) 41,888 (commune); 26,976 (town).

CATAPULT, an engine of war, which had considerable vogue among the ancients. It somewhat resembled a crossbow, and was operated by means of a string or rope, suddenly freed from great tension, which gave a powerful impulse to an arrow placed in a groove. There were various modifications of catapults, but in essential purpose and construction they were all alike. Thus, there were catapults fixed upon a scaffold with wheels, which were used for hurling huge stones in sieges; smaller machines that were readily portable were employed in field operations.

In *acronautics*, a device, such as a truck accelerated on a track by a powerful springs or by the explosion of powder, for launching an airplane at flying speed from the deck of a ship.

CATARACT. The name given to an opaque condition of the crystalline lens of the eye or its capsule. Although recognized from ancient times as a cause of blindness there is little in literature to suggest that early civilizations, as for example the Egyptians, appreciated its real nature. Probably the first to demonstrate the true nature of the condition was Michel Brisseau (1676-1743) who published his observations in 1709. Jacques Daviel (1693-1762) of Paris had the honor of originating the modern treatment of extraction of the lens (1755). Samuel Sharp (1700-1778) of London was first to use the modern cataract knife. Up to the time of Albrecht von Graefe (1828-1870) of Berlin, who achieved phenomenal success in cataract operations, the loss of eyesight in surgical treatment had been about 10 per cent. This was lowered by von Graefe to a little over 2 per cent. The next great advance in the cataract operation was made by Henry Smith of the Indian Medical Service, of Jullundur, India, who perfected his operation of extraction of the cataract within the capsule, one of the most important innovations of modern ophthalmic surgery (1900-1901).

The opaque cataract lies behind the cornea and is not to be confused with an opacity of the cornea, by those unfamiliar with the disease. Cataracts are divided into several classes, the simplest division being into primary and secondary. Primary cataracts develop independent of any other disease, such as diabetes for example. Under these are classed cataracts occurring in young persons (juvenile) or in old persons (senile). Secondary cataracts may develop in the course of diabetes, or from injury (traumatic). Cataracts are also classed as partial or complete the latter involving all of the lens. The condition is painless, being characterized only by gradual loss of vision although the sensation of light persists.

Treatment.—Traumatic cataract due to perforation of the lens may present a complete opacity which is often recovered from without operation, leaving perhaps slight cloudiness with little interference to vision. In some cases surgical measures are necessary for absorption to take place. Senile cataract is the commonest variety and the most important. It occurs generally in persons over 50 and may be several years in developing. Eventually the fluid portion of the lens is absorbed leaving an opaque substance which on further solidification separates easily from the capsule. This marks the stage of ripening, or the point beyond which further delay in operating is unnecessary. The classic operation consists in opening the cornea along nearly half its circumference, with or with-

out removing a portion of the iris, after which the lens is expelled by pressure. After a considerable period, special reading glasses of high refractive power are supplied to take the place of the lens which has been removed. Senile cataracts are generally bilateral but progress at different rates so that one is usually ready for operation before the other. At present the percentage of cases in which useful vision is restored by operation, followed by suitable training and proper glasses, is very large.

HAROLD W. JONES.

CATARACTS, a waterfall, one of the names given to sudden descents in streams of water, the more general English term being fall or falls. A considerable declivity in the bed of a river produces rapids. When it shoots over a precipice it forms a cataract. If it falls from steep to steep, in successive cataracts, it is often called a cascade. In rocky countries rivers abound in falls and rapids. In alluvial districts, falls, of course, are very rare. Rapids and cataracts are often a blessing to rugged countries, since they furnish the cheapest means of driving machines in manufactories. Waterfalls are also utilized in the furnishing of electric power in addition to ordinary water power. Many cataracts are remarkable for their sublimity. Among the grandest and most picturesque in North America is Niagara Falls on the Niagara River dividing Canada and the United States.

The Montmorency River, which joins the Saint Lawrence a few miles below Quebec, forms a magnificent cataract, 250 feet high. The Missouri, in the upper part of its course, descends 357 feet in 16½ miles. There are four cataracts, one of 87, one of 19, one of 47 and one of 26 feet high. The Yosemite River in California forms a series of magnificent falls, with a total descent of 2,600 feet. The first of them is a plunge of 1,500 feet, and is followed, after a series of beautiful cascades, by a final plunge of about 400 feet. Fully 200 miles from the mouth of the Hamilton River in Labrador there is a magnificent series of cataracts known as the Grand Falls, the largest having a height of over 300 feet. In Colombia, South America, a great cataract, that of Tequendama, is formed by the Bogotá River. The river precipitates itself through a narrow chasm, about 36 feet broad, to the depth of over 600 feet. On the Potaro River in British Guiana, the Kaieteur Fall, 740 feet high, and about 370 broad, is a splendid spectacle, and just below it is a second fall of 88 feet.

The most remarkable waterfall in Africa is one with which Dr. Livingstone's missionary travels first made us acquainted. This is a cataract on the Zambesi, called by the natives Mosioatunya ("smoke sounds here"), named by him Victoria Falls. The stream, about 1,860 yards broad, flowing over a bed of basaltic rock, is suddenly precipitated into a tremendous fissure, extending across the bed of the river from the right to the left bank, to the depth of about 370 feet. The breadth of this fissure or crack is only from 80 to 90 yards, and the pent-up waters, from which immense columns of vapor are continually ascending, are then hurried through a prolongation of the chasm to the left with furious violence. The so-called Cataracts of the Nile are not, properly speaking, cataracts. A more correct designation for them would be rapids. The Stanley Falls on the Congo comprise seven cataracts. On the Tugela River in Natal there are the Tugela Falls. On the Umgeni River,

in the same country, are the falls of the Umgeni (364 feet) and the Karkloof Falls (350 feet). There seem to be no waterfalls of more note in Asia than those of the Cauvery (Kaveri) River of India (320 feet).

One of the most striking falls in Europe is the Vettis in Norway. The height of the cataract is 850 feet. In Sweden, on the Göta River, a few miles below its outlet from Lake Vänern, are the celebrated falls of Trollhättan, which have a height of 108 feet. The cascade of Gavarnie, in the Pyrenees, is reputed the loftiest in Europe, being 1,385 feet high. Its volume of water, however, is so small that it is converted into spray before reaching the bottom of the fall. Another waterfall in the Pyrenees is that of Seculėjo, in the neighborhood of Bagnères de Luchon. It descends from the Lac d'Espingo, into the Lac de Seculėjo, or d'Oo, a singularly romantic mountain reservoir, from a height of 820 feet, and is the most copious of the Pyrenean waterfalls. The Swiss Alps likewise contain some falls of great sublimity. At Lauterbrunnen, in addition to numerous other cascades, is the renowned Staubbach Fall, about 1,000 feet high, which, however, from its small volume of water, has none of the terrific adjuncts of a cataract, and resembles, in front, a beautiful lace veil suspended from the summit of the precipice. Near Martigny is the picturesque waterfall of Pissevache, the cascade being 215 feet high. The Falls of the Rhine near Schaffhausen are renowned over Europe. The Rheinfall is 370 feet broad and 100 feet high. In Italy the falls of Terni, or the Cascata delle Marmore on the Velino, have been immortalized by Lord Byron, and, though artificial, are justly regarded as among the finest and most picturesque in Europe. They consist of three falls, the aggregate height of which may be estimated at 650 feet. The falls of the Aniene or Teverone, near Tivoli, are likewise very beautiful. They, too, are artificial, and have a fall of about 80 feet. See also **WATERFALL**.

CATARMAN, kä-tär-män', municipality, Philippine Islands, on the north coast of the island of Samar, situated on the Catarman River, 55 miles north-northeast of Catbalogan. It has a good anchorage ground. In 1871 the town was destroyed by a volcano which burst forth in July from low land on the west side of the island, and in two months had thrown up a hill two-thirds of a mile long, one third of a mile wide and about 450 feet high, destroying all vegetation for miles around. At the time of the visit of the *Challenger*, January 1875, the volcano had attained a height of 1,950 feet, and was still active, there being visible columns of smoke by day and series of small fires at its summit by night. Pop. (1948) 33,153.

CATARRH, kä-tär', a term once in common medical usage to designate inflammations of mucous membranes, in particular those of the nose, throat, and air passages, and accompanied by a discharge or exudate. In modern medical teaching the term is practically abandoned except to indicate occasionally the consistency of a mucous discharge and to distinguish it from one that is frankly purulent. At best it is inexact, and therefore useless to the study of pathology.

CATASAUQUA, borough, Pennsylvania, Lehigh County, altitude 342 feet, on the Lehigh

River, and located on and served by the Jersey Central, the Lehigh Valley, and the Lehigh and New England railroads, and the Reading System, three miles north of Allentown. Anthracite pig iron was made here about 1839. Catasauqua has textile factories, cement works, foundry and machine shops, and flour mills. Incorporated as a village in 1736, it became a borough in 1853. Here is the home of George Taylor (1716-1781), signer of the Declaration of Independence. Burgess and council government. Pop. (1950) 4,923.

CATATONIA, a phase of dementia precox (schizophrenia) in which the individual lacks the will to talk or to move, stands or sits in one position, assumes fixed postures, and resists attempts to activate motion or to elicit speech. Once regarded as a muscular phenomenon, it is now applied to certain types of maniacal outbursts. It is present in many psychoses but is best observed in dementia precox, constituting about 10 per cent of all cases. The stupor is usually of a harmless character, but may be succeeded by a violent outburst in which panic and hallucinations are manifest. In this stage the patient may be dangerous to those about him. Physically, the mental disorder is extremely exhausting. Those afflicted may remain in a strained position for hours, days, or even longer. Instances are known in which a patient has lain rigid in bed for as long as a year without taking any notice of what has gone on about him. Such a case was described most dramatically in one of Guy de Maupassant's stories.

Urination and defecation may take place in bed and food may have to be given through a tube. Two types of catatonia are distinguishable: (1) catatonic stupor in which immobility and mutism are the prominent features; (2) catatonic excitement, in which the patient makes incessant stereotyped movements, walking to and fro within his room or going through the motions of a trade or occupation. He may talk without ceasing, repeating a meaningless jargon over and over, hour after hour. In the most violent forms, the individual may become extremely destructive, making wild dashes and attempting to break everything within reach. If unsuccessful in reducing furniture to bits he may attack with his fists the walls or bars of his room and if not restrained he may be injured. He may even kill anyone who crosses his path. Since he is inaccessible mentally he may be thought to have a completely blank mind. Nevertheless if such a patient recovers from the delirium he may be able to give an intelligent account of what happened and of what was said to him. In general, the chief difficulty of the individual is his inability to make adjustments to the demands of society and especially to those of a normal love life. This incapacity is revealed in distorted behavior which reflects internal conflict. For the most part those who manifest well-developed catatonia of the maniacal type, and who exhibit symptoms for a number of years, are fit subjects for confinement in an institution where proper restraint may be imposed. See also **DEMENTIA PRAECOX**.

Consult Strecker, E., *Dementia Precox Cyclopaedia of Medicine, Surgery, and Specialties*, vol. 4, p. 789 (Philadelphia 1949); Strecker, E., and others, *Practical Clinical Psychiatry*, 7th ed. (Philadelphia 1951).

HAROLD WELLINGTON JONES, M.D.
Editor, "Blakiston's New Gould Medical Dictionary."

CATAWBA, ká-tó'ba, a light and sparkling American wine. See WINE AND WINE MAKING.

CATAWBA RIVER. See WATEREE.

CATAWBAS, a tribe of Indians of the great Siouan family, formerly living on the Catawba River in the Carolinas. They were noted for their courage in fighting the Cherokees, the Iroquois, and the "French Indians" from north of the Ohio; and for their fidelity to the English and later the American interest. Numbering probably 5,000 in 1600, the tribe dwindled through war and epidemics. A few joined the North Carolina Cherokees; others joined the Creeks and Choctaws in Oklahoma; and some, converted to Mormonism, settled in Utah and Colorado. A remnant remains on a small reservation in South Carolina.

Consult Milling, Chapman J., *Red Carolinians* (Chapel Hill 1940); Wright, Muriel H., *A Guide to the Indian Tribes of Oklahoma* (Norman, Okla., 1951).

ANGIE DEBO,
Oklahoma Agricultural and Mechanical College.

CATBALOGAN, kät-bä-lô'gän, municipality, Philippines, capital of the Province of Samar. It is situated on the west coast of Samar Island. A bay at the mouth of the Antigas River, protected by small islands, provides a fair harbor. A trading center for an agricultural area producing rice, hemp, and coconut, its chief exports are copra and hemp. Pop. (1948) 26,839.

CATBIRD, a common songbird (*Dumetella carolinensis*), found in the eastern two thirds of North America and in Bermuda. It receives its name from its mewing catlike alarm note. Related to the mockingbird and brown thrasher, it is an accomplished singer as well as a mimic. The song is bright and varied but somewhat disjointed, melodious notes being intermixed with harsh and squeaky ones. About 10 inches long, it is a trim and slender slate gray bird with blackish crown and a touch of chestnut beneath the tail. The catbird lives in bushes or hedges sometimes in close proximity to residences. The nest of stems and rootlets is well concealed in a bush or dense hedge usually only a few feet above the ground. Four or five dark grayish blue eggs are laid. The old birds scold very aggressively when the nest is approached; at other times the catbird is lively and inquisitive. The catbird feeds upon insects and berries, and is migratory in the northern parts of its range, travelling chiefly at night.

In Australia the name catbird is applied to one of the bower birds (*Ailuroedus crassirostris*), which, like the American catbird, has a mewing cry.

DEAN AMADON.

CATCH, a term applied to the English musical rounds of the 17th and 18th centuries. They were in effect short canons, with each part repeating the phrase another has just sung. The first collection of catches to be published was *Pammelia* (1609), and the most famous was John Hilton's *Catch as Catch Can* (1652-1658). Generally the words sung to the catches were humorous and during the Restoration some were notoriously indecent. The English composer Henry Purcell has numerous catches among his works, and in 1761 a Catch Club was founded in London. Its members, including often royalty, composed or played glees and canons besides catches.

CATCHFLY, the common name for several plants of the family Caryophyllaceae that are characterized by a sticky exudation of the flowers or stems that is presumed to trap insects. Species of the genus *Lychnis* and of the closely related genus *Silene* in particular are called catchflies, but both also have the common name of campion. The German catchfly is *Lychnis viscaria* (sometimes separated into the genus *Viscaria*). Occasionally the Venus flytrap is called Carolina catchfly.

CATEAU, Le. See LE CATEAU.

CATECHESIS, kät-ê-kê'sis (from the Greek *katechiso*, to teach by word of mouth), is applied to the body of Christian truths and precepts which was taught to prospective converts in the early church. Catechization during approximately the first six centuries of Christianity was essentially concerned with the preparation of adults for reception of baptism. It was an initiation into the mysteries of the Christian religion. Early catechesis is best illustrated in the discourses of Peter and Philip (Acts 2:4-36; 8:35-38), and by the preaching of Paul (Acts 17:22-31). Cyril of Jerusalem has left us a remarkable example of patristic catechesis consisting of 24 lectures delivered to aspirants for baptism. By the medieval period it became embodied in formal texts of Christian doctrine, and of such is the content of our modern catechism.

CATECHETICAL SCHOOLS, kät-ê-kê't'i-käl, were institutions for the elementary education of Christian teachers, of which there were many in the Eastern Church from the 2nd to the 5th century. They were different from catechumenical schools, which were attached to almost every church and which were intended only for the instruction of proselytes and children. The catechetical schools, born from the conflict of Christian doctrine with Greek philosophy, were intended to provide a knowledge of Christianity.

The first and most renowned was established about 175 for the Egyptian Church at Alexandria, on the model of the famous schools of Greek learning there. Teachers such as Pantaenus, Clement, and Origen gave them splendor and secured their permanence. They combined instruction in rhetoric, oratory, music, literature, and philosophy, with the principal branches of the theological study, exegesis, the doctrines of religion, and the traditions of the church; distinguished the popular religious belief from the gnosis, or the thorough knowledge of religion; established Christian theology as a science; but, by blending Greek speculations and gnostic phantasies with doctrines of the church and by an allegorical interpretation of the Bible, they contributed to the introduction of heresies. The distraction of the Alexandrian Church by the Arian controversies caused the destruction of its catechetical school c.336.

The catechetical school at Antioch appears not to have been a permanent institution like the Alexandrian, but only to have been formed around distinguished teachers, when there happened to be any in that city. Although some famous men taught in Antioch about 220, we have no certain information of the theological teachers there, such as Lucian, Diodore of Tarsus, and Theodore of Mopsuestia, until the latter part of the 4th century. These teachers were distinguished from the Alexandrians by more sober views of Chris-

tianity, by confining themselves to the literal interpretation of the Bible, by a cautious use of the types of the Old Testament, and by a bolder discussion of doctrines. The Nestorian and Eutychian controversies in the 5th century caused the ruin of the school at Antioch.

Of a similar character was the school instituted at Edessa in 363 and closed in 489, and the school afterwards established at Nisibis by the Nestorians in its stead.

To these schools succeeded, at a later date, cathedral and monastic schools, especially among the western Christians, who, as late as the 6th century, were educated in heathen schools and never had established catechetical schools except possibly at Rome.

P. R. COLEMAN-NORTON.

CATECHISM, kăt'ê-kîz-m (from the Greek *katechesis*), applied originally to religious instruction given orally, has come in modern usage to refer to a treatise in the form of question and answer planned for teaching the elements of religion. In the early Church religious instruction was developed during the period of the catechumenate as to texts and method in the famed catechetical schools of Alexandria, Antioch, Jerusalem, and Rome. The fathers of the church, among them Clement of Alexandria, Origen, and Cyril of Jerusalem, have left us examples of their teaching which are in effect brief compendiums of Christian doctrine. A precise methodology for use in expounding religion to candidates for baptism was the subject of Augustine's treatise *First Catechetical Instruction* (*De catechizandis rudibus*), which appeared c.405 A.D. This work, which exerted a profound influence on subsequent catechetical method, contained three "lectures" graded to the capacity of three different classes of pupils. The subject matter of the catechetical teaching from the early beginnings of the church was divided according to the four major headings: the Apostles' Creed, the Ten Commandments, the Sacraments, and Prayer. This division of the entire field of Christian doctrine still prevails in practically all modern catechisms of the Christian churches.

Since the time of Martin Luther, the term "catechism" has been used to designate a compendium of Christian doctrine for children and youth that is arranged in the form of question and answer. The question and answer form of religion text was in use much earlier. The first manual resembling our modern catechism that is extant is a treatise by Alcuin or a member of his school at Aachen and is dated about the year 800. The title of this work is *Disputatio puerorum per interrogationes et responses*. It is an extensive explanation of Christian truths from the creation to the Lord's Prayer. The 16th century witnessed the publication, made possible by the invention of printing, of a large number of catechisms both with and without the question and answer form. Luther brought out his *Primer of Religion* in 1520 and his *Smaller Catechism* appeared in 1529, followed shortly afterwards by his *Larger Catechism* intended for the clergy and schoolteachers. The latter two works were arranged in questions and answers. The catechism of John Calvin for children was published in 1537, and an Anglican catechism was printed with the first *Book of Common Prayer* in 1549. Graded catechism became the rule: for beginners, for youth, and an advanced text for adults and teachers. The

Shorter Catechism used by Presbyterians was printed and adopted in 1648. St. Peter Canisius published the first popular Catholic catechism in three grades in 1555 and the catechism of St. Robert Bellarmine appeared in 1597. The newly defined doctrines of the Council of Trent (See TRENT, COUNCIL OF) were incorporated in what has been known as the *Catechism of the Council of Trent* which was published without the question-answer arrangement in 1565.

The catechism today retains its place as a basic text for teaching the tenets of the various faiths. No longer merely a formal exposition of truths and practices, it is graded and tested as to vocabulary range to fit the age and learning capacity of children and youth. It is embellished with pictures and apt illustrations together with such study aids as exercises, cases of conscience, and tests. Recent development of audio-visualization has brought about widespread use of catechetical films, both motion pictures and slide films, incorporating in whole or in part the content of the catechism.

JOSEPH B. COLLINS,
Director, Confraternity of Christian Doctrine,
National Center, Washington, D.C.

CATECHU, kăt'ê-chōō, the extract prepared from the wood of some trees of the West Indies, especially from the *Acacia catechu*. It is used in dyeing and tanning; also in medicine as a powerful astringent. Catechu, usually sold in solid form, can be dissolved in hot water or alcohol. It contains about 25 per cent catechutannic acid, the main factor of its effectiveness.

CATECHUMEN, kăt'ê-kū'mĕn (from Greek *katechoumenos*, instructed), is the name applied during the early centuries of the church to one undergoing instruction in Christian belief and precept. The word appears in Galatians 6:6. The system of instruction and discipline which gradually developed for reception of converts from paganism was called the catechumenate. Since apostolic times there had been a practice of preparing individuals for admission into the Christian community by a preliminary instruction. This can be seen in the informal teaching and preaching of the apostles as found in the Acts. By the end of the 2d century the catechumenate was well established, and reached its highest point of effectiveness during the two following centuries. The period of probation or initiation into the Christian mysteries varied in length for different communities. It consisted of two classes: the catechumens, properly so called, or *audientes* (listeners); and the competents or elect, that is, those seeking or chosen for reception of baptism. The neophytes or those who had completed their preparation and were baptized are improperly included as a third category of the catechumenate.

The adult who expressed a desire to become a Christian was subjected to a kind of novitiate which included instruction on the doctrines of the church, its moral precepts, and its life of prayer; hence it was an intellectual, moral, and ascetical education. Cyril of Jerusalem has left us a series of 24 lectures which he delivered to catechumens and neophytes in the middle of the 4th century, and the technical pedagogy of the catechists in preparing catechumens is illustrated in the famed treatise of Augustine called the *First Catechetical Instruction* (*De catechizandis rudibus*).

The catechumens were not bound by the

Christian rule of life in all its full severity, but they were outwardly associated with and enjoyed all the privileges of the Christian community. They participated in most of its services, although only in that part of the Mass which included the opening ceremonies and the sermon, called the Mass of the catechumens. They were not permitted to be present for the recital of the Creed and the solemn canon of the Mass with the reception of the Eucharist. All this was a remote preparation for baptism; and a prospective convert could remain in this state as long as he desired. Sometimes a catechumen remained for years, even to the end of his life, with only a formal desire to become a Christian in order to benefit at the last possible hour by the baptismal absolution of all his sins. The Emperor Constantine remained a catechumen until his deathbed baptism.

If a catechumen decided to complete his period of preparation and the church authorities approved his motives and qualifications, he gave his name to the local pastor and he was formally enrolled among the "competents." A rigorous period of instruction was then begun which usually took place during Lent. It included explanations of the Creed and the Lord's Prayer as well as the principal duties of a Christian. An examination, called the scrutiny, was held around the end of Lent and the elaborate ceremonies of baptism were held on the vigil of Easter or in some places on the vigil of Pentecost. The newly baptized neophyte was clothed in a white garment, a sign of purity of soul, the Sacrament of Confirmation was solemnly administered, and he partook of the Holy Eucharist for the first time—all on Easter morn.

The custom of admitting children to baptism and the necessity of receiving large numbers of individuals into the church after the onset of the barbarian invasions caused a gradual decline of the discipline of the catechumenate; its disappearance in most places was marked by the end of the 5th century. It remains today only in vestiges of the rite of baptism and reception into the church as found in the ritual of the Christian church.

JOSEPH B. COLLINS,
*Director, Confraternity of Christian Doctrine,
National Center, Washington, D.C.*

CATEGORICAL. In traditional logic, a statement is called categorical if it makes a single assertion, unconditionally and without alternatives. Thus "Columbus discovered America" is a categorical statement as distinguished from such hypothetical statements as "If the Norse did not arrive first, Columbus discovered America" and the disjunctive statement "Either the Norse discovered America or Columbus did." As may be seen from these illustrations, hypothetical and disjunctive statements contain components which are categorical. In this sense, also, a syllogism is called categorical if its premises and conclusion are categorical statements.

Kant made use of this notion in ethics by dividing injunctions to act, or *imperatives* as he called them, into hypothetical and categorical. A hypothetical imperative gives a command conditionally, on the assumption of a certain aim or purpose. Thus "If you wish to arrive on time, hurry!" is a hypothetical imperative and has no force for one who does not wish to be on time. Such imperatives can never form the basis of a universal ethics since the injunction can be escaped by deny-

ing the aim stated in the condition. If there is to be any ethic binding on all rational beings it must, Kant argues, be based on a categorical imperative, i.e., one without conditions. Kant claims there is such an imperative most frequently stated as follows: "So act that you could will the maxim of your action to be a universal law." The maxim here is simply the principle on which a person acts and the force of the injunction is to claim that one should act when and only when he could wish that the principle of his action be adopted universally. This command is unconditionally binding and so is categorical.

PAUL HENLE.

CATEGORY. In the philosophy of Aristotle, categories represent the ultimate types of being. Thus one may say of something that it is a chair, of a chair that it is a piece of furniture, of a piece of furniture that it is an artifact, and so on going to broader and broader characterization until one comes to substance. Here one can give no broader description, hence substance is a category. In a similar fashion one may say of red that it is a color, of color that it is a quality, and here one stops; hence quality is a category. Aristotle gives varying lists of categories, the most complete in the *Categories* includes: substance, quantity, quality, relation, space, time, situation, state, action and passion (being acted on). Situation is differentiated from place in that it refers to such characteristics as being right side up or upside down rather than merely giving a location. Similarly state (for example, is shod) differs from quality (for example, is red) in applying most specifically to one part of a whole.

Aristotle's treatment of the categories strikingly differentiates substance from the other categories. It is distinguished from them principally by not being in anything else (that is, not being a characteristic of anything else) and by its ability to take on contrary characteristics. Thus a chair may have its color changed without ceasing to be that chair, but nothing falling under one of the other categories can undergo similar change. Substance, moreover, is divided into two sorts: *primary substance* or individual things (for example, individual men or chairs) and *secondary substances* (for example, the species, man, or the type, chair). Primary substances may only be subjects of discourse and may never be predicated of anything. Secondary substances may be predicated of primary (for example, one may predicate "man" of Socrates, but one cannot predicate Socrates of anything).

Kant also made use of the term "category" in reference to a different problem. The British philosophers of the Enlightenment, from Bacon through Hume, had tried to show that knowledge derives entirely from experience. The attempt was a failure and, in Hume's development, the result was skepticism. Kant accepted Hume's reasoning, agreed that if experience were the only source of knowledge the result would be skeptical, but argued, since there is knowledge, it must have some source in addition to experience. This source he found in certain forms of perception and in certain concepts by means of which we organize our experience. These concepts he called "categories."

A parallel to Kant's general view of the categories is given by some contemporary accounts of the influence of needs and mental sets upon perception. It is generally admitted that per-

ception is not a simple recording of effects upon the sense organs, but rather is influenced by the state of the individual as well. Thus a hungry person is more likely to notice food than a well-fed one, and a coin looks larger to a poor child than to a richer one. In somewhat the same way, Kant claims that our experience of the world is not simply given from without, but is the result of a process of organizing our sensations by means of certain concepts. Thus, we think of the world in terms of cause and effect not because there is any direct sensation of causes in the way that there is of colors and shapes, but because causation is one of the ideas which the human mind inevitably uses in the interpretation of experience. Kant holds that causation and the other categories are the same for all people and that the objectivity in our judgments depends upon their use.

In the *Critique of Pure Reason* Kant sets himself the task of discovering a complete list of categories and of showing that they must apply to all experience. In the former inquiry he discovers 12 categories in all, arranged in four groups of three—the categories of quality, quantity, relation, and modality. Of these, the individual categories of cause and substance are most important. The proof that the categories apply to all experience attempted in the "transcendental deduction of the categories" is one of the most difficult arguments to be found in any philosophy.

As a result of this doctrine, Kant distinguishes between things as they are in themselves and things as they appear when organized by the categories. The latter he calls *phenomena* and he argues that scientific knowledge is confined to phenomena.

These two conceptions of category, Aristotle's as the basic types of being and Kant's as basic forms of thought, have been most influential in the history of philosophy. Other views have been intermediate between these. In contemporary philosophy, however, the term is used loosely to refer to any generic concept.

PAUL HENLE,

Professor of Philosophy, University of Michigan.

CATENA, kă-tă'nă, **Vincenzo di Biagio**, Venetian painter: b. Venice, Italy, c.1470; d. there, 1531. He was probably a pupil of Giovanni Bellini, whose style he closely follows in his earlier pictures, as in the *Madonna and Child* (Walker Gallery, Liverpool). In 1505 he worked in Giorgione's studio, and the pictures of his later period are strongly influenced by that famous painter. His masterpiece from that time is the *Martyrdom of St. Christina*, painted in 1520 for the altar of the Church of Santa Maria Mater Domini, Venice.

CATERPILLAR, kăt'ēr-pīl-lēr, the young or larva of a moth or a butterfly that hatches from the egg and when full grown develops into the pupa or chrysalis followed by the adult stage. The head is usually large and bears from two to six simple eyes on each side, and a pair of very small, three-segmented antennae. The segments of the thorax each bear a pair of true legs: these are chitinized, tapering and jointed. They are used not only for crawling but also for holding food in position during feeding. In most caterpillars there are five pairs of pro-legs, false legs or stump legs, situated on the third

to sixth and the 10th abdominal segments: however in some, such as the measuring worms (*Geometridae*), all but the two hind pairs of body legs may be missing. The pro-legs are short and stumpy and terminate in a circle of crochets or hooks which is usually entire, but interrupted in the Microlepidoptera.

There has been no agreement among entomologists as to the correct designation of the proper common names for lepidopterous larvae. In the literature we note caterpillars referred to as appleworm, budworm, cabbage worm, cankerworm, case-bearer, fireworm, fruitworm, hayworm, hornworm, girdlers, leaf rollers, leaf-tiers, looper, meal worm, miner, perforator, podborer, silkworm, skeletonizer, spanworm, tentmaker, webworm, woolly bear and other similar designations. With so many different common names used to designate a particular species, no wonder the layman finds entomological nomenclature confusing. These various designations also give some idea of the characteristics and habits of caterpillars.

Since the Lepidoptera (q.v.) is generally considered to be one of the largest orders of insects, estimated at about 150,000 species, it is reasonable to expect that there are innumerable kinds of caterpillars. These larvae vary in length from 3 millimeters in the small miners, up to 150 millimeters for the largest. In shape they may be elongated, cylindrical, slender, or robust, or they may be flattened or otherwise adapted to fit a particular environment. The colors are usually cryptic so as to match immediate surroundings, but some may be brightly hued and beautifully ornamented with remarkable designs. The surface may be smooth, velvety, shiny or wrinkled and may be clothed in fine, scarcely visible hairs or spines, as is the case with the many cutworms and other caterpillars, or they may be slightly to densely hairy or even spiny like the so-called woolly bears, the tussock and brown tail moths. The larvae of many of the butterflies are rather smooth and naked, but this is by no means true of all species. They may also have various kinds of body tubercles or filaments, and the caterpillars of the swallowtail butterflies of the genus *Papilio* have a pair of delicate tentacle-like or hornlike processes or so-called "scent horns" which are retractile and which when protruded give off a very pungent odor which is believed to be a protection against birds and other enemies.

Caterpillars, which are the growing developing condition of butterflies and moths, are voracious feeders, for they must, in a relatively short time of a few weeks, store up enough food supplies to carry them over through the resting and transformation period known as the pupa or chrysalis stage and the final development into the adult moth or butterfly, which is one of the most remarkable phenomena of the living world.

Caterpillars and the larvae, pupae, and adults of most insects furnish food for many animals, including primitive man. A great many birds are wholly dependent upon this means of subsistence and especially for rearing their young. To destroy the insects would be a fatal blow to these wonderful creatures, and we should be mindful of this fact when appraising the values of insects and especially caterpillars to the economy of man and many other animals.

Much has been written concerning the value

of insects, and especially caterpillars, as food for primitive man. In a recent work 435 separate papers have been listed on this subject, which gives some conception of the importance of insect larvae, in particular, as a source of food.

Modern travelers to Mexico will tell you that one of the delicacies offered to the elite is called "Gusana de maguey," or caterpillars of the maguey, which are prepared by frying them in their own fat.

The most important caterpillar in history is the silkworm (q.v.) which is only now being gradually pushed into oblivion by man-made synthetic silk and substitutes thereof. Silk was first obtained from the cocoons of wild silkworms. The first domesticated caterpillar was the Chinese silkworm, which antedates recorded history, and this insect has been so long in captivity that it can no longer live without the experienced care of man. There are many varieties of this particular species, *Bombyx mori*, and there are also some nine or ten other species of caterpillars that have produced a variety of kinds of commercial silk. Recent wars and the use of synthetic fabrics have greatly reduced the production of silk.

E. O. ESSIG,

Author of "College Entomology."

CATESBY, kâts'bî, Mark, English naturalist: b. probably London, England, c.1679; d. London, Dec. 23, 1749. After studying natural science in London he traveled in North America in 1710-1719 and 1722-1725. He was the author of *Natural History of Carolina, Florida, and the Bahama Islands, with Observations on the Soil, Air, and Water*, 2 vols. (1731, 1743). Others of his books contain the fruits of his studies of bird migration, and of fishes, reptiles, and insects of the Isle of Providence. Catesby influenced the introduction of many American trees and shrubs into English gardens by publishing his *Hortus Britanno-Americanus* (?1737).

CATFISH, a fish of any one of about two thousand species of more than twenty families of fishes of the suborder Siluroidei, order Ostariophysi, representatives of which are found in all warm and temperate seas and in the rivers and streams of all continents. They are extremely varied in size, ranging from creatures an inch long to those of 10 feet and 600 pounds weight. They are extremely varied in specialized structures which enable some to live for long periods out of water; others to live, blind, in caves and in the bottoms of rivers; at least one species protects itself and perhaps secures food by using electric discharges it can produce from a layer of skin. Some can travel overland. Others live in the gills of larger fishes. Some live in waterfalls and others gnaw holes in the sides of larger fishes. From these they draw blood on which to live. A number of them construct nests of one sort or another for the reception of their eggs, burrowing out holes under rocks or simply in the river bottoms; some blow masses of frothy bubbles for their eggs, and some carry the eggs about in their mouths, while still others carry the eggs in a layer attached to their bellies. Some are reported to develop folds of tissue from the lips in which the eggs are carried, and others attach them to a solid surface and apparently forget them.

The body is naked, or covered by bony plates,

and has no true scales. About the mouth are two or more barbels, the longest being at the corners of the mouth. There is usually a stout, generally serrated, spine in front of the dorsal fin, and often another in front of the pectoral fins. These spines are likely to inflict considerable injury if carelessly handled. Some small species, such as the madtoms of North America, have venom glands at the base of the pectoral fin spines. Wounds caused by these can be extremely painful. This is one of the most widely distributed groups of fishes, and is especially abundant in South America and in Africa.

Catfish are sluggish in movement and are mostly bottom feeders, where they eat whatever they find. Some concentrate on algae which they scrape from the stones on which it grows. Because of their size and abundance they form an important food item in the countries in which they are found, but because of their feeding habits their flesh is not considered of high quality. North and Middle America contain about one hundred species, of which a third may be found in the United States and Mexico. The majority are not of much commercial importance but a few have considerable local value. Of these the channel cats of the genus *Ictalurus* are the most sought. They range from the Prairie provinces and the Hudson's Bay region of Canada through most if not all of the Mississippi Valley and southward to Florida and northern Mexico, typically in lakes and larger rivers. The method of capture is usually by "trot lines," which sometimes are a mile long. The catfish move with the seasons, north in spring and summer, south in fall and winter, spreading over swamps and adjacent land at the time of the spring floods. At this time they may be caught on "brush lines." Along the southern Mississippi the blue catfish, *I. furcatus*, is the most important. This averages about twenty pounds but reaches 150 pounds. The range of the white cat of the Potomac, *I. catus*, crosses that of the blue, but this fish is smaller and may be distinguished by the very wide head and the deeply forked tail. Several species have been successfully transplanted into Californian waters. The bullheads, *Ameiurus*, found only in North America, afford considerable sport to anglers, and are edible.

The armored catfishes are peculiar to South America and some of the smaller species, such as the *Corydoras*, and smaller specimens of other families are well known in domestic aquaria. There are also some freshwater catfishes in Australia, the only representatives of the order Ostariophysi found there.

Malapterurus, the electric catfish of the fresh waters of tropical Africa, has been known for many years as a peculiar fish. It was pictured in Egyptian hieroglyphics, and one of its names, translated, means "he who frees many," possibly referring to the fact that a fisherman with one in his net would probably be so shocked by the electricity that he would drop his net and thus release the entire catch. The electricity is produced by chemical means in a layer of tissue between the outer skin and the muscle tissue. It has been recorded as exceeding 400 volts, but most specimens probably do not reach this.

Best known of marine catfishes, or Ariidae, are the gaff-topsail catfish, *Bagre marinus*, found from Panama to Cape Cod, and the sea catfish, *Galeichthys felis*, which runs from Texas to Cape Cod. Usually found near river mouths, they are

more plentiful in the southern parts of their range. They are naked, with long barbels and an adipose fin. Large eggs of the gaff-topsail, as well as young fry, are carried in the male's mouth. Another sea catfish, *Arius*, rather abundant in the West Indies and along the Atlantic coast of South America, is often called the crucifix fish because of the formation of the bones of the inner wall of the skull which resembles a crucifix. The outer skull bones were thought to look like a shield or breastplate, which gave the fish its name, *Arius*, meaning martial. This fish has also been known under the generic name, *Sciadeichthys*.

C. W. COATES.

CATGUT, a tough cord made from the intestines of different quadrupeds, particularly those of sheep, but never from those of the cat. The manufacture is chiefly carried on in Italy and France. The texture from which it is made is that which anatomists call the muscular coat, which is carefully separated from the peritoneal and mucous membranes. After a tedious process of steeping, scouring, fermenting, and inflating, the material is twisted, rubbed with horse-hair cords, fumigated with burning sulphur to improve its color, and dried. Cords of different size, strength, and delicacy are obtained from different domestic animals. The intestine is sometimes cut into uniform strips with an instrument made for the purpose. To prevent offensive effluvia during the process, and to get rid of the oily matter, the French make use of an alkaline liquid called *eau de javelle*. Catgut for stringed instruments, as violins and harps, is made principally in Rome and Naples. For the smallest violin strings three thicknesses are used; for the largest seven; and for the largest bass viol strings 120. It is well known that the membranes of lean animals are tougher than those in a high-fed condition, and there can be no doubt that from the lean and small-sized Italian sheep strings superior to all others are produced. In Naples, whence the best treble strings, commonly called "Roman," are obtained, there are large manufactories of this article. Catgut is also used for surgical sutures and for bowstrings.

CATHA, kăth'ă, a genus of plants belonging to the order Celastraceae, or staff-tree family. The species are mostly natives of Africa, forming small shrubs, sometimes with spiny branches. *Catha edulis* is a native of Arabia, and from the leaves the Arabs make a beverage possessing properties analogous to those of tea or coffee. Under the name of *kât* or *kafta*, the leaves form a considerable article of commerce among the natives. Chewed, they produce wakefulness and hilarity of spirits.

CATHARI, kăth'ă-rî, the name given to themselves by the adherents of numerous heretical sects, undoubtedly of Gnostic and Manichean origin, which swarmed in western Europe, and particularly in northern Italy and southern France, in the 12th century. At that period society had much advanced in wealth and power, which brought their concomitant vices. There were many abuses prevalent in the church, and some of the clergy led scandalous lives. The numerous heretical sects won adherents by violently and indiscriminately denouncing the entire hierarchy, from the pope down to the monastic or-

ders; but their tirades were not more emphatic than the philippics launched against the same scandals by sincere Roman Catholics, their contemporaries, such as Saint Bernard, Saint Hildegarde, Saint Malachi, archbishop of Armagh, and others. But while these sought to procure the eradication of the current abuses by a reformation from within the church, the Cathari (Gr. *katharos*, Lat. *mundus*, *purus*, and *puritanus*, pure, clean) aimed at nothing short of the total destruction of the dominant religion, of its whole system of belief and even of its moral teaching. For not only were the sects styled Cathari (including a host of offshoots of eastern Manichæism), heretics, and reformers, but in their inner circles, dualists, believers in the existence of two supreme principles, the one a good principle, God, and the other an evil principle, the creator of the material world. But open profession was not made of this tenet; it was communicated only to the inner circle in the several Manichean sects, to the elect ones, the *perfecti*, but withheld from the mass of their followers, the *credentes*, the faithful vulgar. To these latter and to outsiders the adepts of the *arcana* of catharism made profession of being strictly reformers of a corrupt ecclesiastical system, and of profound regard for the letter and spirit of the moral law as taught in the apostolic writings. As already said, they enthroned the evil principle as creator of the physical universe; they believed in the divine mission of Jesus Christ, the Son of God, that is, of the good principle; but with the Docetæ they denied that the Son of God had assumed human nature really, and held that his humanity was phantasmal only. In conformity with their tenet of a supreme principle of good and a supreme principle of evil, the initiates condemned as works of the flesh the sacraments of the church as a whole, and looked on the contract of marriage as sinful. They held absolute predestination: that all men belong to one or other of two classes, those who will infallibly be saved, and those who cannot possibly attain holiness: hence their doctrine that an infant dying immediately after birth, if it belongs to the class of those predestined to be lost, is punished as is Judas in hell.

CATHARINE. See CATHERINE.

CATHARTIC, purgative, a medicine used to produce evacuation of the bowels. A laxative is a mild cathartic or purgative tending more to loosen the bowels without the production of watery evacuations. Cathartics may be given by the mouth or by rectum. The effect of cathartic drugs is to stimulate peristalsis of the intestine. This may occur by an increase in bulk of the contents of the intestinal tract through the ingestion of substances containing a large proportion of indigestible matter such as bran or coarse vegetables; by ingesting substances which absorb water and swell, such as agar, psyllium seed, etc. (demulcents); or by drinking salines, that is, magnesium sulphate, which draw fluid into the intestinal tract by osmosis. Certain cathartics act by direct irritation of the intestinal mucous membrane, an example being calomel. A simple and well recognized classification of cathartics on a basis of their action contains 3 general groups. The first includes the laxatives which are mild and act rather slowly with production of a movement within 24 hours. The

second includes the purgatives which are either vegetable cathartics or salines which produce a copious movement in from 1 to 12 hours. The third group is made up of the drastic purgatives of vegetable origin which exert a powerful irritant effect in a short time and are in fact seldom used.

Laxatives.—Classed with laxatives are certain diets containing a large amount of fruit, vegetables, whole wheat, bran, etc. Other laxatives are agar, mixed generally with cooked cereal. Most of the agar is excreted in a large movement within 24 hours. *Plantago seed* (*psyllium seed*) contains a mucilaginous principle producing bulky stools. Liquid petrolatum or mineral oil forms a waterproof coating in the intestine and increases the bulk of the fecal mass by slowing absorption of water. It has the objection of interfering with vitamin absorption.

Simple Purgatives.—These compose most of the cathartic drugs. Among the most widely used is *cascara sagrada*, the dried bark of a shrub containing anthraquinone derivatives. It is intensely bitter unless taken as the aromatic extract and its effect is almost entirely on the colon. It acts within 12 hours, producing a slight griping and is extremely effective. *Cascara* can be repeated and is possibly the best laxative since it is not particularly habit-forming and can be discontinued after regular bowel habits are established. Other laxatives contain *aloe* and *belladonna* in pill form. *Aloe* is likely to cause severe griping. *Senna* is more irritant than *cascara* but is in wide use. *Rhubarb* is efficient in about 8 hours but may have the after-effect of constipation. *Phenolphthalein* is a white powder of synthetic origin acting in 8 to 12 hours. It is efficient even after repeated use but irritates the colon and causes skin rashes. *Castor oil* is of value in emptying the bowel rapidly if the intestine contains toxic matter. *Calomel* (mild mercurous mercury) is a powerful irritant cathartic acting slowly with griping. The saline purges are milk of *magnesia*, *magnesium carbonate*, *magnesium sulphate* (Epsom salts), *sodium phosphate*, and *Seidlitz powders*. Drastic purgatives—these form a small group such as *Jalap* and *Podophyllin*. They are extremely irritant, acting on the small intestine, and are not often used. See also CONSTIPATION.

Consult Wright, Harold N., and Montag, Mildred, *Textbook of Pharmacology and Therapeutics*, 5th ed. (Chicago 1951).

HAROLD WELLINGTON JONES, M.D.

CATHARTIDAE, ká-thār'tí-dē, in zoology, the American vultures, a family of birds of the order accipitres or Raptores, differing from the more eagle-like Old World vultures (*Vulturidae*) in having the beak comparatively slender, straight, and blunt, the complete absence of a septum between the nostrils, the much more largely naked head and neck, and the weak feet with elevated hallux and but slightly curved claws. Altogether they are less predaceous birds, which feed exclusively on carrion or attack weakling animals. Five genera, each with but one or a few species, are found in America, more especially in the warmer parts. Among them are the carrion crow, the condor, and the turkey buzzard (qq.v.).

CATHAY, ká-thā', name used in the Middle Ages by Marco Polo and others to designate China. It is derived from the Persian *Khitai*, a

kingdom in north China established in the 10th century by the Khitans, a Tatar race. In modern Russian, the name for China is *Kitai*.

CATHCART, Sir George, British army officer: b. London, May 12, 1794; d. Crimean Peninsula, Russia, Nov. 5, 1854. The 3d son of William Schaw, 1st Earl Cathcart (q.v.), he joined the army in 1810, and during 1812-1814 he served as his father's attaché in Russia. From 1815 to 1818 he was aide-de-camp to the Duke of Wellington; and in 1838 he went to Canada in command of the King's Dragoon Guards. Appointed governor and commander in chief at the Cape of Good Hope in 1852, he subdued the rebellious Kaffirs and Basutos. With outbreak of the Crimean War (q.v.) he was given command of a division. He was killed at the Battle of Inkerman. His *Commentaries on the War in Russia and Germany in 1812 and 1813* was published in London in 1850.

CATHCART, Sir William Schaw (1st EARL CATHCART), British army officer and diplomat: b. Petersham, Sept. 17, 1755; d. Glasgow, Scotland, June 16, 1843. He was the son of Charles Cathcart, 9th Baron Cathcart (b. 1721), and succeeded him in 1776. Entering the army, from 1777 to 1780 he served in North America in command of the "British Legion," an irregular corps, and during 1793-1795 he took part in the campaigns against the French in the Low Countries. In 1801 he reached the rank of lieutenant general, and from 1803 to 1805 he was commander in chief in Ireland. He led the expedition to Hannover in 1805, and in 1807, after commanding the land forces in the attack on Copenhagen, he was created a viscount for his services. In 1812, with the rank of general, he was sent to Russia as ambassador and military commissioner. He accompanied Emperor Alexander I in the campaigns against Napoleon, and in 1814 he received an earldom. Until 1821 he continued as ambassador at St. Petersburg.

CATHEDRAL. See CATHEDRALS AND CHURCHES.

CATHEDRAL, The, a novel by Hugh Walpole, published in 1922.

The central figure of the story is Adam Brandon, archdeacon of the great English cathedral of Polchester, and the theme is the archdeacon's fateful decline from the heights of dignity, authority, and esteem to the depths of isolation, humiliation, and bitterness. His greatest enemy is himself, in that he suffers, much as did Greek tragic heroes, from the deadly blindness of pride. Through a series of misadventures, most of which could have been minimized or even avoided altogether by a more humble and perceptive man, Brandon loses his only son to a girl of whom he cannot approve; his wife to another man; his influence to a clerical rival; and ultimately both his mental balance and physical health to the gradual inroads of corrosive rage and frustration. His death from a sudden attack of apoplexy takes place at a routine meeting of the cathedral chapter just after he has suffered his final, cumulatively symbolic defeat at the hands of his rival.

Important characters of the novel, apart from Brandon, are his lonely, colorless wife, Amy; his rebellious son and loyal daughter; and his shrewd, deceptively benign, clerical adversary, Canon Ronder. Always in the background, Polchester

Cathedral broods like a sacerdotal sphinx over the cathedral town and its inhabitants.

Considered Walpole's most important work, *The Cathedral* tells a highly dramatic and impassioned tale of minds both noble and mean, of emotions both lofty and base, in prose which now and again rises to poetic power.

CATHEDRAL, The, a poem by James Russell Lowell, published in Boston in 1869. The particular cathedral which suggested the thought of the poem is that of Chartres.

CATHEDRAL OF SAINT JOHN THE DIVINE. See CATHEDRALS AND CHURCHES.

CATHEDRAL PEAK. (1) A mountain of the Sierra Nevada range, 10,933 feet in height, situated in the northeastern part of Mariposa County, Calif. It is in Yosemite National Park, and contains the source of the Merced River. (2) A mountain in Pitkin County, Colo., in the west central part of the state, 14,100 feet high. (3) A mountain in Yellowstone National Park, northwest Wyoming, having a height of 10,600 feet.

CATHEDRAL SCHOOLS. See ALMONRY SCHOOLS.

CATHEDRALS AND CHURCHES. A cathedral (from Greek *καθέδρα*, "seat") is the administrative church of an ecclesiastical diocese presided over by a bishop and usually located in a town or city. It customarily includes the *cathedra*, or chair, of the bishop. Since the Reformation the word has sometimes been used by nonepiscopal faiths to designate churches of exceptional size or importance. Differentiated from cathedrals are monastic and parish churches, which will be discussed later.

The great period of cathedral building in Western Europe was the late 12th and the 13th century, when episcopal centers tended to shift from the rural monasteries to towns, many of these newly founded. Between 1170 and 1270 approximately 80 cathedrals were constructed in France alone. In form these Gothic cathedrals evolved from the wood-roofed Early Christian basilicas in response to physical, liturgical, and administrative requirements, and some knowledge of the requirements is necessary to an understanding of this cathedral form.

The liturgical activities within a Gothic cathedral were similar to those of the earlier monastic cathedral, although its canons or priests were not bound by such specific rules of common life. These activities centered in the almost continuous celebration of divine worship with its varied round of services, processions, and festivals. *Matins* began the canonical hours and were observed as early as midnight in some cathedrals—at sunrise in others. *Lauds* followed, after which the Mass of the Virgin was celebrated. The bell announcing *prime*, or the first of the canonical hours, was rung soon after. *Tierce* was said about 9 o'clock, with *High Mass* at 10 followed by *sext* and *nones*. Evensong might be said about 3 in the afternoon, with *vespers* and then *compline* at 7 or 8 P.M.

The most important daily service was that of High Mass, but many special services, such as those of Christmas, Easter, and Pentecost, and those on anniversaries of particular saints, in-

volved special features. Most services culminated at the high altar and were conducted primarily in the presence of the clergy. Elaborate processions played an important part in the services and these necessitated easy entrance and exit to several sections of the cathedral and easy circulation about it. Provision had to be made for the display of relics either to those assembled in the nave or to pilgrims visiting the several chapels. The circulation of pilgrims from chapel to chapel and to the crypt beneath posed a formidable architectural problem. The safeguarding of the relics and of the cathedral treasure was also of high importance, as was the need for the instruction of the faithful by visual as well as auditory means. Above all, however, was the need for fire resistance, since the cathedral was often situated in the midst of closely packed combustible houses and there was no adequate fire-fighting equipment. Added to these requirements were others relative to various needs and activities of the residentiary canons and vicars, a meeting place for the conduct of ecclesiastical business, space for the accommodation of penitents and alms seekers, a school, and a library. With this sample view of life within a medieval cathedral, we are better prepared to examine its architectural form and setting.

The physical location of a cathedral was usually impressive. One might cite the massive bulk of Durham rising from a granite ledge above the valley of the Wear or the upspringing silhouette of Chartres surmounting a geometric melange of rooftops.

In general form the cathedral of western Europe followed the long rectangular shape of the Early Christian basilican church, was entered from the west, and reached its climax in the high altar at the east. Its central space or nave might be flanked by single or double aisles. In France, Flanders, Germany, and Spain these continued in a semicircular ambulatory about the high altar. In England, the aisles formed a rectangular eastern termination. An example of this simple type may be seen in the cathedral at Bourges, its impressive length visually emphasized by the lack of any cross arms.

Most cathedrals incorporated in the general rectangular shape described above a cross arm or transept—slightly emphasized, as at Notre Dame in Paris, or vigorously expressed, as at Ely in England. Such a single transept formed a Latin cross in plan. Where two such transepts were employed, as was common in England, their double arms formed a patriarchal cross.

Towers served as high platforms for the ringing of bells and when capped with spires, as was usually intended, they served as vertical symbols of the faith—harmonious aesthetic elements of a dynamic whole. Simplest in tower arrangement was the cathedral with but a single western tower placed over the entrance, as at Ulm, Germany, or over the crossing of nave and transept, as at Norwich, England. Notre Dame, Paris, illustrates the more usual French arrangement, with two western towers and a slender spire or *flèche* over the crossing. Laon in France was planned for seven towers, two flanking the western façade, and each transept façade, and a *flèche* over the crossing. Chartres was planned for nine towers. The dramatic role played by the crossing towers in admitting a flood of top light is strikingly illustrated in some English cathedrals, where large central towers were especially featured.

The continental cathedrals usually fronted on an open square. It was there that the drama of the miracle plays was partly or wholly enacted. It was there that goods were often sold in open stalls on market days. It was there that the narrow but principal streets of the town often debouched. Small wonder that the town felt itself a vital part of the visible church: the people lived in its presence, contributed to its fabric, and participated in its liturgical drama. For their instruction, the portals and façade were adorned with saints and sinners, enhanced by gilt and color. Feudal lord and market woman were alike reminded of the horrors of hell by the Last Judgment over the central door. The Wise and Foolish Virgins warned them of the penalty of unpreparedness. At Notre Dame, Paris, the lamb giving its own wool bespoke the Virtue of Charity. And although the western façades of the English cathedrals played a less important role than those of France, their didactic imagery was similar and abundant.

Entrance to the cathedral for the people was usually through a narthex or vestibule. The canons customarily entered from the cloister, if there was one.

The interior space, suffused by jewel-like color from multitudinous windows, was divided into three major parts: nave, choir, and sanctuary. Supplementary to these were the retrochoir, the ambulatory, and the chapels containing subordinate altars and shrines.

The nave on the west or entrance side was for the laity, although sometimes regarded by the canons as a prelude to the choir and the more sacred area beyond. It frequently had its own altar, located on the west side of the choir screen and used primarily for the lay congregation, though also used for some of the minor services of the canons. The baptismal font was found at the opposite end, near the entrance. Sermons received diverse emphasis in the medieval cathedral and varied in length from brief meditations to lengthy exhortations. Sermons to the clergy were ordinarily delivered in Latin from a lectern within the choir. Those to the people were delivered in the common tongue from a pulpit located west of the choir screen. Worshipers in the medieval cathedral stood or knelt and benches for the laity only appear in western Europe from the 14th century.

The choir space containing the stalls of the clergy might begin at a point several bays west of the crossing—a common practice in Spanish cathedrals—or at the eastern side of the crossing. It was usually at a higher level than the nave. The choir stalls, whether or not accompanied by a choir screen, served to separate this space from the side aisles. These stalls were often assigned according to the rank of the canons. In many cathedrals, the dean was the immediate head under the bishop, served as the executive authority of the cathedral, and occupied the first stall to the south of the choir. In some cathedrals, the provost or archdeacon occupied this position. The opposite stall was assigned to the precentor, who had charge of the singing. If the bishop was present he might occupy his throne, the dean's stall or, in some instances, a special stall. The high altar, the most sacred element of the cathedral, usually stood at the east end of the sanctuary and was elevated by one or two steps. This altar alone was required to stand free so that it might be asperged from all sides and

was planned with ample space before it for the celebrants and his assistants. It was often flanked by richly embroidered riddel curtains to protect the flickering candles and was sometimes dramatically backed by a decorative screen or reredos.

The development of the space around and behind the altar provided for the easy circulation of canonical processions and pilgrim visitors and for chapels and shrines containing the relics of saints, kings, and bishops. At Canterbury, England, it was the shrine of Thomas a Becket which attracted thousands of pilgrims and a kingly treasure of gold and jewels. At Le Mans, France, the circling ambulatory was studded with thirteen radiating chapels. At Reims the generous ambulatory space facilitated the coronation ceremonies traditionally held there.

Structurally the Gothic cathedral was based on the principle of arch and vault, a dynamic mode of construction, as the arch and the vault are constantly tending to thrust themselves apart. Only the opposition of the powerful external stone buttresses maintained the necessary balance. Such a stone covering as was provided by rib and vault made the cathedral relatively secure against fire, although the lead-covered timber roof above the vault remained vulnerable. This was demonstrated by the fire at Reims in 1481, in which the lead of the roof melted and ran through the gargoyles to the ground and the roof timbers were consumed, but the 20-inch thick stone vault remained intact. The demonstration was repeated during World War I, when the bombardment of Reims was followed by fire. Again the lead covering was melted and the timber trusses burned, but the stone vault survived.

Separate from the cathedral but closely related to it were the canonical residences, the chapter house, the library, and other necessary buildings. It is regrettable that so few of these auxiliary structures still stand, for such ensembles gave the cathedrals their maximum exterior effects.

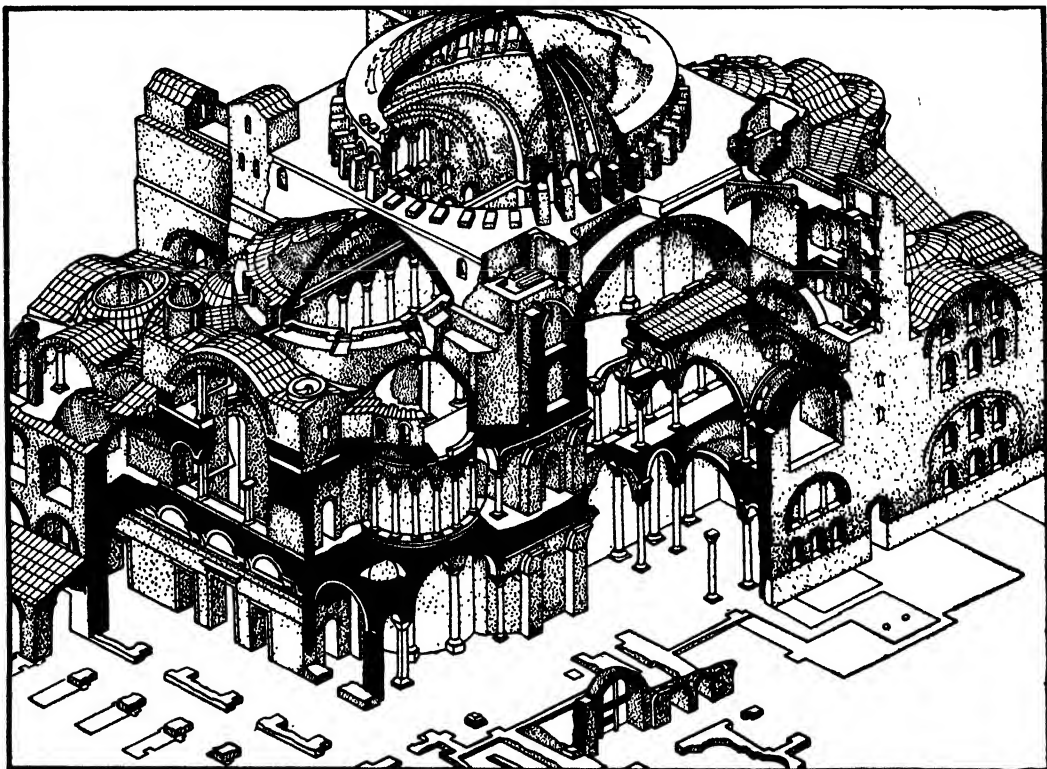
Cathedrals in eastern Europe developed in contrast with those of the west. The Byzantine empire centered in the teeming city of Constantinople, and Constantinople is located at the mouth of the Black Sea, where east and west do meet. In the eastern church the bishop was known as the patriarch or metropolitan. The requirements of his ecclesiastical seat were similar to those of his western counterpart—calling for narthex, central space or nave, choir, and sanctuary, usually arranged in ascending levels. However, the form of the eastern cathedral was symmetrical about a central point rather than along a central line as in the west; the eastern cathedral was a circular, octagonal, or square building rather than a rectangular one. Separation of the sexes was customary in the eastern church, with women frequently assigned to the gallery, which was in consequence called the gynaeceum. The altar of the eastern cathedral was more completely separated from the choir than the altar of the Gothic cathedral. This more complete separation was accomplished by an iconostasis, or image-bearing screen, which was pierced by three doorways.

The supreme achievement of the Byzantine builders was the cathedral of Hagia Sophia, or Divine Wisdom, in Constantinople. In plan, this cathedral combined a suggestion of western rectangularity with eastern centrality. It was

erected between 532 and 537 by two architects from Asia Minor, Anthemius of Tralles and Isidorus of Miletus, and featured a great central brick dome (107 feet in diameter) shouldered by half domes on the east and west. Massive buttresses rose above the aisles and galleries on north and south to absorb the outward thrust of these domes. The entrance was from the west through an open court, an outer and inner narthex. Within, the light from the 40 windows at the base of the central dome, augmented by that from 174 others, reflected the myriad colors and golden glow of the mosaic which sheathed the walls and vaults.

The type of the later Byzantine cathedral and church was established by the Nea Ekklesia, or new palace church, in Constantinople. This church had five domes rising from a square plan, the highest above the center at the crossing of two

vision for them and stimulated the study of mathematical relations in space. Harmonic proportions drawn from musical analogies, symmetry, and the precise use of classic columns, pediments, and ornament gave the Renaissance cathedrals a temple-like appearance. On their interiors the same elements governed and Roman vault types replaced the ribbed vaults of the Gothic era. Major worship and administrative requirements differed but little from those of the medieval period, although the work of the preaching friars and of such fervent spirits as Savonarola had increased the importance of the sermon. In music, Gregorian plain song had been developed into part singing and then into harmonic compositions. And although the Post-Reformation saw the building of numerous Protestant churches and some changes in worship, the Renaissance cathedral form persisted even in Protestant churches.



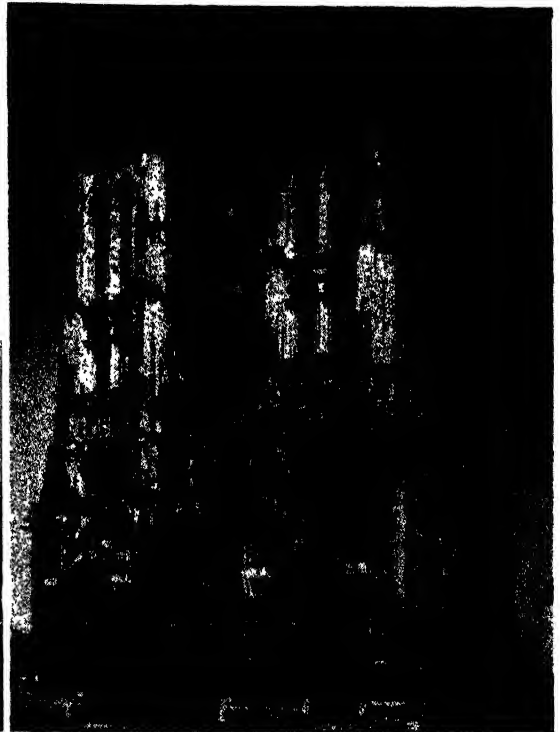
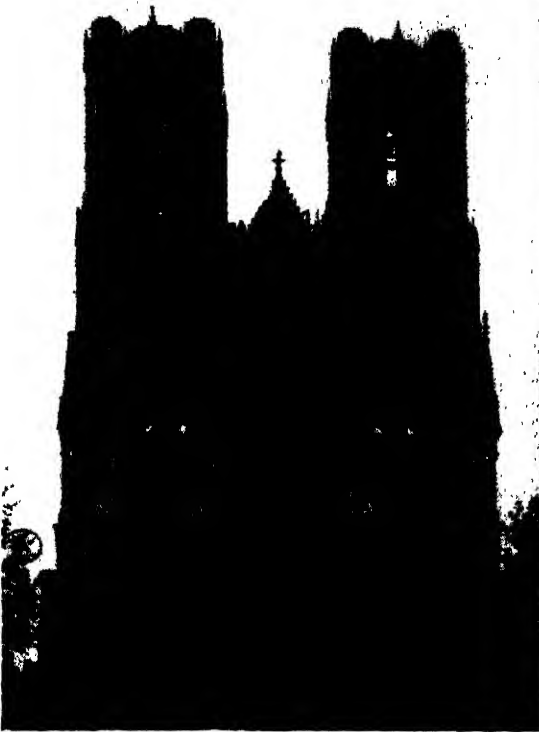
Hagia Sophia (532-537) in Constantinople (Istanbul), Turkey. Cut-away perspective after drawing by Henri Prost in H. d'Espouy's *Monuments Antiques: Supplément*, Paris.

barrel vaults. Four lower domes surmounted the four corners. Although nothing remains of the Nea itself, its general form is reflected in hundreds of cathedrals and churches in Russia and Greece and throughout the Balkans. Among these one of the most beautiful is the 12th century Cathedral of the Assumption at Vladimir, Russia. This cathedral was built of white sandstone and capped by five helmet-shaped domes. It has long been regarded as the crowning achievement of the Russian builders and was taken as the model for later cathedrals.

The Renaissance cathedrals of western Europe illustrate the change of ideal wrought by the classical studies of the Humanist scholars. To the Renaissance architects Gothic cathedrals seemed barbaric. They had been won over by the classic geometry of antiquity. The discovery of the laws of perspective opened a new world of

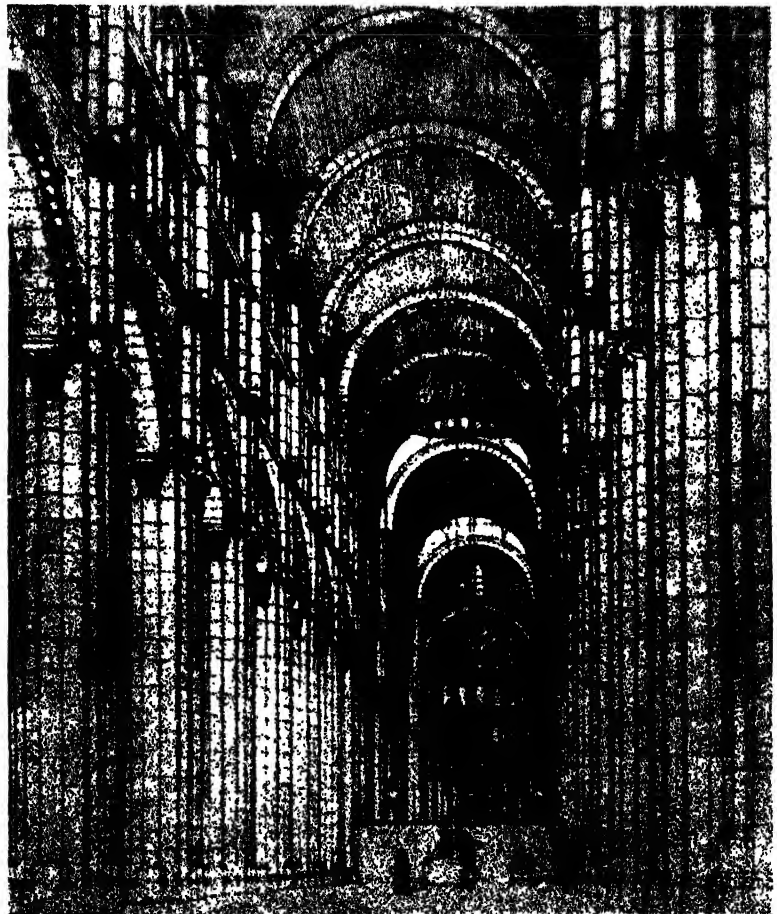
St. Peter's, Rome, is the outstanding representative of the period. In the 120 years of its building, successive architects alternated between central and basilican plans. The final form, that of a Latin cross, was achieved by the architect Carlo Maderna. Both nave and transepts of St. Peter's are covered by semicircular barrel vaults, 150 feet high, and above their intersection rises Michelangelo's vast dome, 138 feet in diameter. This dome is visually supported on the exterior by a drum of coupled columns. However, its real stability depends, as does the stability of most Renaissance domes, on girdling chains embedded in the walls. Such concealed construction differs markedly in external expression from the construction of the Gothic cathedrals, in which the visible buttresses act in contrapuntal rhythm to oppose the concentrated thrusts of the internal vaulting. Very different also are the classical

CATHEDRALS AND CHURCHES



Above: Two beautiful 13th century French Gothic cathedrals, Notre Dame at Reims (left), and Notre Dame at Amiens (right). Below: Interior of Abbey Church at Cluny, France, 10th century, as restored by Kenneth J. Conant.

Photographs (above) courtesy Clarence Ward; (right) from drawing by Turpin C Bannister



CATHEDRALS AND CHURCHES



Above: Interior, St. Martin's-in-the-Fields, London. Below: Tabernacle Church of Christ, Columbus, Indiana.

Photos (above) from "The Architectural Setting of Anglican Worship" by G. W. O. Addleshaw and F. Etchells, published by Faber and Faber Ltd., (below) © Hedrich-Blessing, Chicago



columns, mouldings, and pediments in comparison with the slender colonnettes, pinnacles, and pointed arches of the Gothic builders. With the Renaissance a new architectural world had dawned and its form was determined by new ideals rather than by new requirements.

England at the beginning of the 18th century saw Christopher Wren's masterpiece, St. Paul's Cathedral, nearing completion in London. In St. Paul's, as in St. Peter's, Rome, the dome at the crossing is the dominant element, but that of St. Paul's seems more serene in its studied simplicity. Two towers flank the two-story façade, while within, a series of saucer-domed bays leads to the 112-foot dome at the crossing.

In Europe few complete cathedrals were built in the rich Baroque style which flourished during the 17th century probably because the diocesan centers were already established. However, in South America and Mexico a number of cathedrals did come under this Baroque influence, often in combination with Gothic vaults or classic interiors. Such is Cuzco (Peru) Cathedral, begun in 1560 but only completed in 1653. It is rectangular, with three Gothic vaulted naves of equal height carried on immense classic piers. The façade has a full Baroque portal set against the bare reddish-brown stone.

In the 19th century two revival styles, Gothic and Classic, vied for supremacy. In 1789, the same year in which George Washington took his oath of office as president of the new American republic, the numerous Catholic parishes in the United States were constituted into a diocese and Baltimore became the episcopal see. A new cathedral was imperative and Benjamin Henry Latrobe, a London-trained architect, was commissioned to prepare designs. He presented two, one Gothic and one Classic. The latter was accepted and finally erected, although Latrobe made many modifications during the period of construction (1806-1821). Built of granite on a cruciform plan, Baltimore Cathedral was probably the first domical church of any kind in the eastern part of the United States. The present onion domes capping the towers, the Greek Ionic portico, and the eastward extensions were all built later.

Russia in the 19th century took pride in the erection of the classic Cathedral of St. Isaac in St. Petersburg (Leningrad). This was designed and built by the French architect Richard de Montferriand. Magnificently placed in the great square which extends some 1,800 feet from the river, it presents a huge rectangular mass surmounted by a dome and four corner cupolas. Porticoes extending from the four faces modify the central block into a cruciform shape. The columns of each portico are of rose granite and, with their bronze capitals, attain a height of 56 feet. Because of the marshy nature of the site, the dome was constructed of cast and wrought iron, an example of lightened construction undoubtedly known to the American architect, Thomas Ustick Walter, when he designed the iron dome of the national capitol in Washington, D.C., in the face of similar soil conditions.

Most 19th century cathedrals in the United States were Gothic or Gothic Revival, as the style is commonly called. St. Patrick's Cathedral (1858-1879) in New York is a famous example. It was designed by James Renwick, probably with Cologne Cathedral in the back of his mind, and was the first major Gothic Revival cathedral

to be built in the country. Granite is the major material. However, the vault is of wood and plaster, eliminating the necessity for flying buttresses, although external pinnacles suggestive of buttresses are employed.

A second example in New York City rises from Morningside Heights. This is the Cathedral of St. John the Divine, originally designed in an eclectic medieval style by George Lewis Heins and Christopher Grant LaFarge in 1888 but transformed into French Gothic by Ralph Adams Cram in the years following 1911. It is comparable to the largest European cathedrals in size, surpassed only by St. Peter's and the cathedral at Seville. Its vault is poised 124 feet above the floor and its nave has the immense span of 100 feet. The total length is 601 feet.

In Washington, D.C., the Episcopal Cathedral of St. Peter and St. Paul by Henry Vaughan and George F. Bodley is similar in general form, although more English in its vaulted interior. It occupies a splendid site above the Potomac and it will have a total length of 504 feet when completed. Since the death of the original architects the work has been carried on by Frohman, Robb, and Little.

Christ's Cathedral, Liverpool, designed by Sir Giles Gilbert Scott, was begun in 1904. Also magnificently located, on an abandoned quarry high above the city, its red sandstone bulk is clearly visible to ships approaching the harbor. The cathedral is cruciform with double transepts. Although Gothic in inspiration, it is not copyistic and incorporates massive walls and piers in place of the customary Gothic lightness. The interior vaults, 116 feet high, rise to 176 feet in the central space under the tower. Heating is of the radiant type, with warm air circulated in under-floor concrete flues—the first large-scale installation of this type of heating in England.

Churches.—Churches may be broadly classified under two main headings, monastic (including collegiate and friars' churches) and parish. Both categories might be further subdivided according to allegiance, geography, chronology, and other differentiations. However, geographical and chronological variations resembled those of the cathedrals, and cathedrals by reason of their importance were usually the major influences in the architectural expression of any given time and place.

The great period of monastic church building was the 11th and 12th centuries, the pre-Gothic period commonly called Romanesque. It was in the late 11th century that the third abbey church at Cluny was begun and the influence of this church spread far and wide among the 2,000 dependencies of the Cluniacs. The church was a big one, 615 feet long, with massive walls seven and one-half feet thick. It stood to the north of the cloister around which the life of the Cluniac brothers revolved. Its plan was that of a double-armed or patriarchal cross, with double aisles on either side of the central space. It bristled with nine towers. Its eastern termination included the semicircular ambulatory with radiating chapels for Cluny, and its dependent churches were pilgrimage churches with many relics and many altars. Nine major services were celebrated during each 24-hour period and, as in the cathedrals, processions played an important part. The interior of Cluny was vaulted by a 100-foot catenary barrel vault reinforced by transverse arches and lighted by round-arched windows. Space was divided into nave,

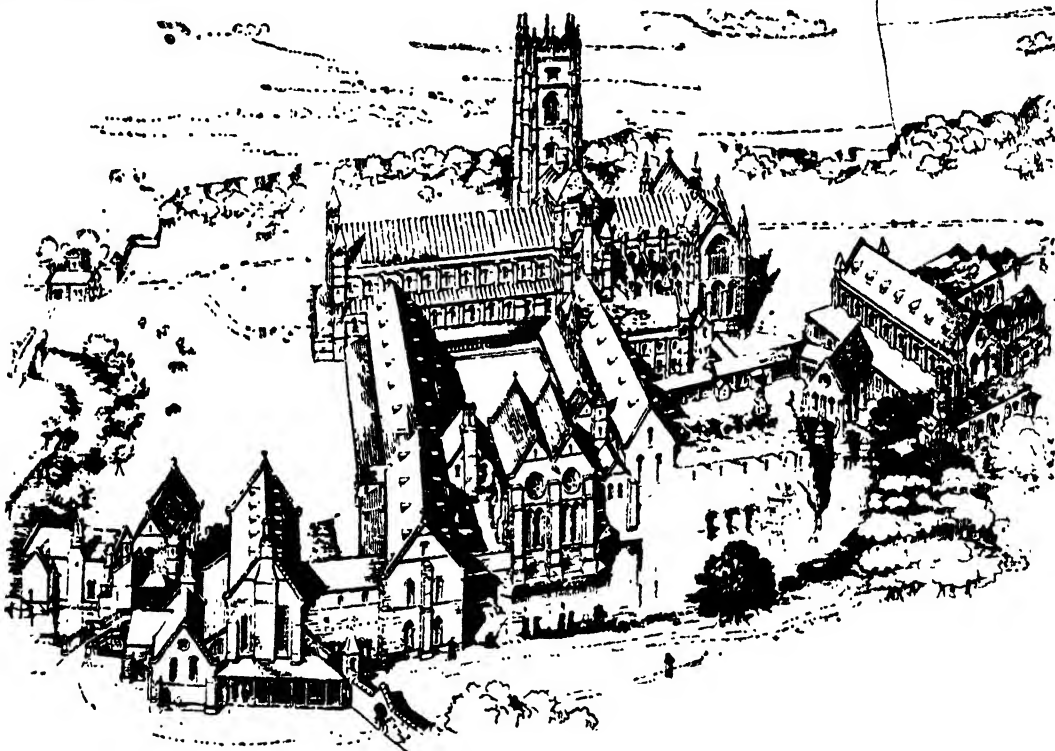
choir, and sanctuary in an ascending order of importance, though the nave was seldom used. The Cluniacs delighted in carving, color, and windows of jewel-like glass.

The Cistercians, on the other hand, were anti-decorative. Their churches, although contemporary with those of Cluny, bespeak their extreme asceticism. Their abbey at Fontenay has no towers. Its interior, covered by a pointed barrel vault, is relatively low and bare. Its eastern termination is rectangular. The conventional buildings around the cloister share this atmosphere of severity. Nevertheless, the relationship of building to building, the relationship of landscape elements, and the absence of decorative detail usually resulted in an effect of peaceful and beautiful simplicity. Years diminished the Cistercian architectural asceticism, however, and after 1200 ornamental features were used with

Both attached great importance to preaching. The consequences of these beliefs are to be seen in their churches. Usually located in the poorer, more crowded districts of the cities, they sought to provide maximum clear space at minimum cost.

The Franciscan Church of Santa Croce (1294-1442) in Florence, by Arnolfo di Cambio, is an example. Its interior volume is about double that of the Cathedral of Notre Dame, Paris, but its vast nave is covered by timber trusses instead of vaults and its exterior is of brick instead of stone. Even Franciscan austerity did not endure, however, and with the accumulation of wealth, elaboration of their churches inevitably followed.

For the Dominicans a church with a double nave divided by a row of columns, a "hall church," became the accepted type. It is illustrated by the Dominican church in Toulouse, France.



Fountains Abbey, near Ripon, England. A Cistercian abbey, begun in 1132, now in ruins. This artist's reconstruction shows relation of abbey church to monastic buildings. Drawing reproduced from Sir Banister Fletcher's *A History of Architecture* by permission of B. T. Batsford Ltd., London, publishers.

greater freedom. A classic example of this relaxation of austerity in Cistercian architecture is the Abbot Huby tower which was added to Fountains Abbey, Yorkshire, in 1494-1526. A specimen of late and rather coarse Perpendicular, it contrasts strikingly with the austere 12th century nave. Though the order was never as large as the order of Cluny, the Cistercians' abbeys numbered 1,800 by 1260, and it was the Cistercians who carried the new Gothic style to Italy.

Succeeding the Benedictines and Cistercians and, in one sense, the bishops and canons of the cathedrals, were the friars of the late 13th and the 14th centuries. Of the orders of friars the Franciscans and Dominicans were chief. Both believed themselves called to work among the masses. Both began in austerity, with the Franciscans placing special emphasis on poverty.

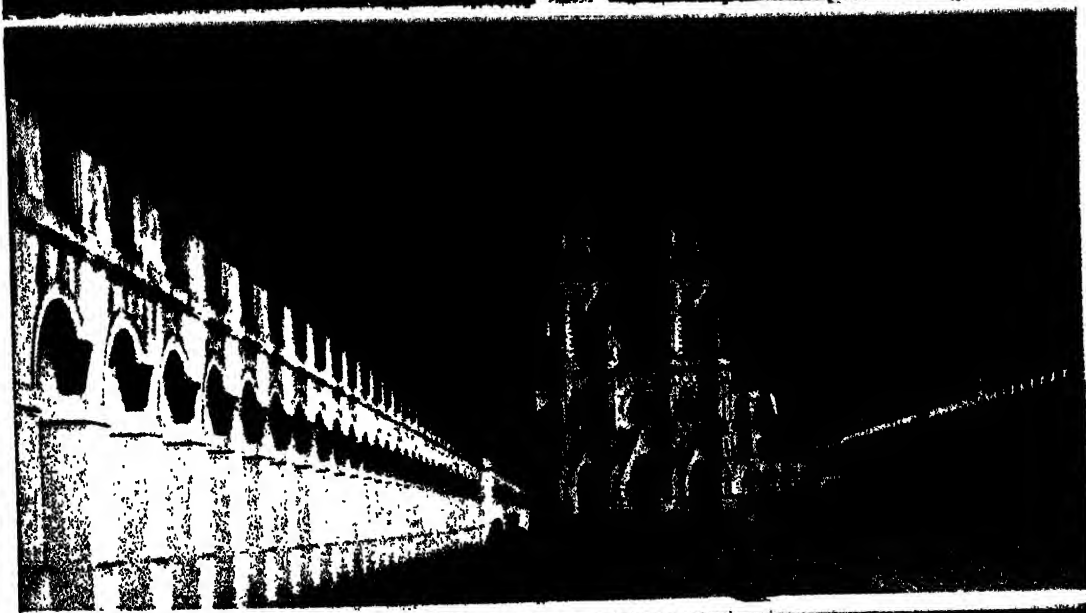
The change in ideals introduced by the Renaissance, of course, affected monastic churches as well as cathedrals. A key example in the so-called Mannerist style (i.e., post-Renaissance style of the 16th century) appears in Il Gesù, Rome. It was built for the Society of Jesus, an order especially identified with the Counter Reformation. Begun in 1568, this church combined the medieval longitudinal scheme with the central scheme of the early Renaissance—by no means a new conception. The two-story façade of Il Gesù had likewise been anticipated a century or more before. What was new was the dramatic handling of light in the interior space, the purposive contraction and darkening of the vaulted bay preceding the crossing space in order that the light pouring down from the dome above would bring a sense of fulfillment. Another feature was the development of the two transept altars, one dedi-

CATHEDRALS



Top: Notre Dame Cathedral from the Quai Montebello, Paris.

Standard Oil Company (New Jersey)



Center: The Cathedral of Lujan is an accessible pilgrimage center, 41 miles from Buenos Aires, Argentina.

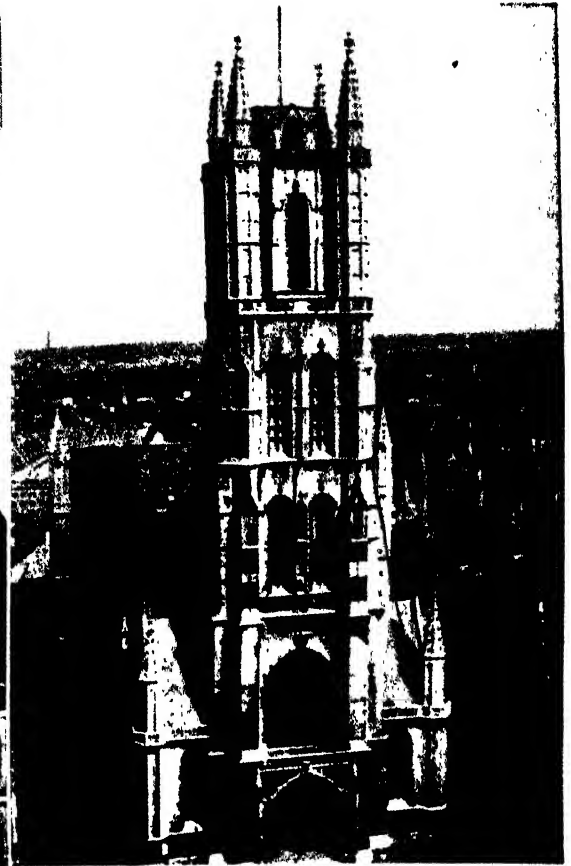
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Right: St. Paul's Cathedral, London, masterpiece of the famous architect Sir Christopher Wren.

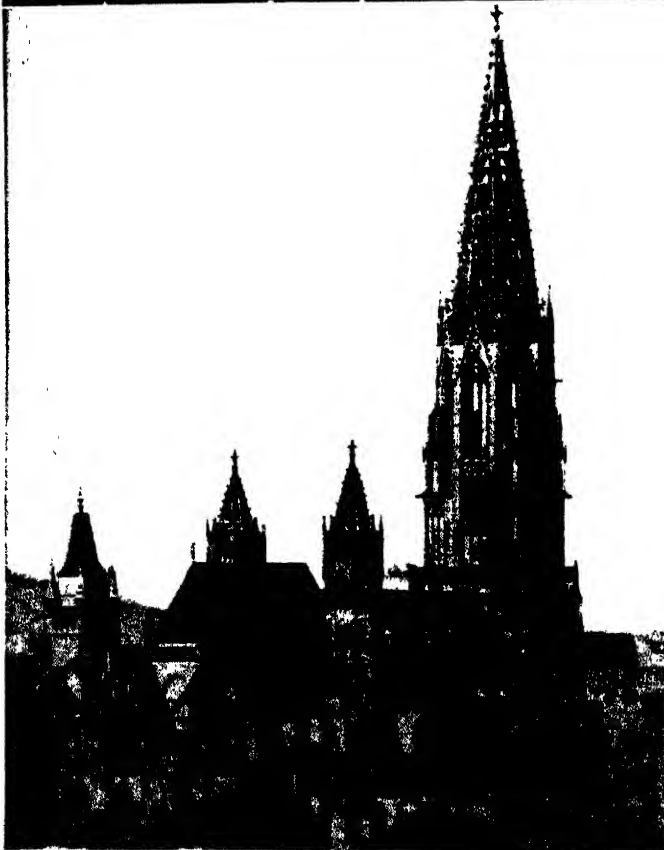
British Information Services



CATHEDRALS



Upper left: The Cathedral of Mainz, in Hesse, Germany, on the Rhine. This Romanesque building dates from the 11th century.



Upper right: St. Bavo's Cathedral in the historic town of Ghent or Gent, Belgium.

Belgian Government Information Center

Left: This beautiful Gothic cathedral is at Freiburg im Breisgau, Baden, Germany, at the edge of the Black Forest.

German Tourist Information Service

cated to St. Ignatius of Loyola, the founder of the order, the other to St. Francis Xavier. Above the lower arcade of the nave, balustrades and grilles were incorporated. These permitted the novices to hear the sermons and participate in the services without being seen, an arrangement which became characteristic of Jesuit churches.

In the 18th century Baroque monasteries of South Germany and Austria, the abbey churches were brought to a dazzling crescendo of undulating walls, complex interior spaces, and sparkling decorative compositions carried out in pink, gold, and white and employing a full orchestration of all the arts. In such monastery churches as Weingarten (1723), near Lake Constance, and Melk (1702), overlooking the Danube, one is invariably charmed by the delicacy, the vivacious movement, and the illusory effects attained.

Parish churches, though less important in establishing architectural trends, are omnipresent in the western world. Almost every medieval village and hamlet had its parish church. York, England, with a population of 11,000 in the 14th century had 45 parish churches. Thousands of medieval parish churches still remain to us and to these have been added tens of thousands in other styles.

The function of the parish church was to serve the religious needs of the people of the parish, the district within reasonable distance of the church. In doing this the church usually served a broad social purpose as well and won a large place in the affections of the people. Within the pre-Reformation English parish church mystery plays were performed, property deeds were stored and, at certain festivals, dancing was allowed in the nave. Fairs were held in the parish churchyard and contracts were often signed under its entrance porch.

Parish churches range through every conceivable type and style. Some are like rustic huts; others are as large as cathedrals. Some were built in one great campaign, while others literally grew bay by bay as needs developed. Some have aisles, some do not.

Representing the survival of the Gothic tradition is St. Thomas's Church in New York City, designed by Bertram Grosvenor Goodhue in 1906 and splendidly comparable with its medieval prototypes.

In complete contrast, yet beautifully expressive of simplicity and studied relationships, is the Chapel of the Transfiguration at Moose, Wyoming, designed by the Reverend R. H. Balcom. In this the breath-taking view of the Tetons becomes the reredos against which the altar is placed.

In the struggle toward the more economical and efficient spanning of space with the relatively new material of reinforced concrete two examples seem especially worthy of citation. One is the church of St. Jean l'Évangéliste, Paris, designed by Anatole de Baudot in 1894, when the theory of reinforced concrete was just being formulated. The other is Auguste Perret's Notre Dame du Raincy (Paris), designed in 1922. Both are pioneer expressions of the material and, as such, experimental.

Many other new notes have been sounded in the design of churches to meet contemporary needs with contemporary materials and technology: the Church of Christ in Columbus, Indiana, by Eliel Saarinen; St. Ann's, Normandy, Mis-

souri, in which the architect, Joseph D. Murphy, received whole-hearted collaboration from the stained glass craftsman-designers, Frei and Harmon; the small and highly adaptable Methodist church which Schweikher and Elting built in Plainfield, Iowa; the highly imaginative Unitarian church in Madison, Wisconsin, by Frank Lloyd Wright; and the churches of Pietro Beluschi in Portland, Oregon. These and scores of others attest that the 20th century is making its contribution to the house of God and is significantly symbolizing the creative spirit of man's devotion.

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ALAN K. LAING,
*Professor of the History of Architecture, and
Chairman, Department of Architecture, Uni-
versity of Illinois.*

CATHELINEAU, kât-lê-nô', Jacques, French Vendean general: b. Pin-en-Mauges, Maine-et-Loire, Jan. 5, 1759; d. St.-Florent-le-Vieil, July 4, 1793. In March 1793 he helped assemble a band of local recruits for an insurrection against the Republicans and led them thereafter. The storming of Cholet was the greatest of his military exploits. He combined with other Vendean leaders in the taking of several more towns and became the commander in chief of the whole force after the taking of Saumur in June. In the decisive attack on Nantes Cathelineau was mortally wounded and the army was repulsed. He was often referred to as the Saint of Anjou.

CATHER, kăth'ēr, Willa Sibert, American author: b. Winchester, Va., Dec. 7, 1876; d. New York, N. Y., April 24, 1947. When she was still a child, her family moved from Virginia to Nebraska, where she lived until she completed college. She attended high school in Red Cloud and was graduated from the University of Nebraska in 1895. Her love for music and literature helped her decide to leave the country and live in a city. She went to Pittsburgh, Pa., and worked on the staff of a newspaper, later teaching English at Allegheny High School. It was at this time that her first writing was published: a volume of poetry, *April Twilights*, in 1903 and a collection of short stories, *The Troll Garden*, in 1905. From 1906 until 1912 she was an editor of *McClure's Magazine* in New York City, becoming managing editor in 1908. After the publication of her first novel, *Alexander's Bridge*, in 1912, she devoted all her time to creative writing. She traveled widely in Europe and the United States and once tried to make France her permanent residence. Her love for the prairies brought her back to America. Miss Cather was often considered one of three or four outstanding novelists whom the United States produced in the first half of the 20th century. She was given honorary degrees from Columbia, Princeton, Michigan, Nebraska, California, and Yale universities. The last years of her life were spent in New York City; she was buried at Jaffrey, N. H.

The beauty of style in her writing as well as

the selection of narrative material made her work widely appreciated and admired. Her earliest success came from stories of the Nebraska plains: *O Pioneers!* (1913), *The Song of the Lark* (1915), and *My Antonia* (1918). She was interested in immigrant families who were living in Nebraska at the close of the 19th century and especially admired the pioneering spirit. In the majority of novels she wrote of the sensitive person or artist who finds himself unable to compete in a mercenary world. She also used this theme in such successful short stories as *A Wagner Matinee* and *The Sculptor's Funeral* which are in the collection *Youth and the Bright Medusa* (1920). Her great love for music is evident in the choice of characters as well as in the writing.

A Lost Lady (1923) is frequently judged her finest novel. In a study of the decline of a woman of refinement Miss Cather pictured the changing social pattern and the commercializing of America's Middle West in the early days of the 20th century. Two of her most popular novels are *Death Comes for the Archbishop* (1927) and a story of Quebec, *Shadows on the Rock* (1931). *One of Ours* (1922) was awarded a Pulitzer Prize for fiction. In *Sapphira and the Slave Girl* (1940) for the first time she used her birthplace, a farm in Virginia, as a setting, but the novel was not considered one of her major achievements. Her other published work includes: *The Professor's House* (novel, 1925); *My Mortal Enemy* (novel, 1926); *Obscure Destinies* (short stories, 1932); *Lucy Gayheart* (novel, 1935); *Not Under Forty* (essays, 1936); and *The Old Beauty, and Others* (short stories, published posthumously, 1948).

CATHERINE, Order of Saint, the name of two organizations of very different character: (1) The Knights of Saint Catherine on Mount Sinai, a medieval military order, instituted for the protection of the pilgrims who came to visit the tomb of Saint Catherine of Alexandria on this mountain. (2) A former organization in Russia, constituting a distinction for ladies, and instituted by Catherine, wife of Peter the Great, in memory of his signal escape from the Turks in 1711.

CATHERINE, Saint. (1) **SAINT CATHERINE OF ALEXANDRIA**, Christian virgin and martyr: b. Alexandria, Egypt; d. about 307. According to legend, she publicly confessed the Gospel at a sacrificial feast appointed by Galerius Valerius Maximinus, at that period governor of Egypt, and was put to death by beheading after a vain attempt to torture her on a spiked wheel. Hence the name of Catherine wheel (q.v.). Her body was conveyed by angels to Mount Sinai, where the monastery of Saint Catherine was built. No less than 50 heathen philosophers who were sent to convert her in prison were themselves converted by her winning eloquence, whence she is the patroness of philosophers and learned schools. Having steadily rejected all offers of earthly marriage, she was taken in vision to heaven, where Christ plighted his troth to her with a ring. This subject has been a favorite one with many artists (as signifying the union of the redeemed soul with Christ), the Christ being usually represented as an infant. It has been suggested that the attributes of the unhistorical Saint Catherine seem to have been derived from those of the ac-

tual Hypatia, a heathen who suffered death at the hands of Christian fanatics. Her festival falls on November 25. (2) **SAINT CATHERINE OF SIENA**, one of the most famous religious of Italy: b. Siena, Italy, March 25, 1347; d. Rome, April 29, 1380. At the age of 16 she took the habit of a Dominican Tertiary, that is, the third order, living under the rule of Saint Dominic while remaining at home. Therefore, afterward she was a patron saint of the Dominicans. Gifted with extraordinary spiritual insight, she felt conscious of a divine message to take part in public affairs. Acting on this belief, she corresponded with the principal rulers of Italy, and in 1377 she was able to prevail upon Pope Gregory XI, for the sake of the church, to leave Avignon and return to Rome. In 1378 Pope Urban VI summoned her to Rome, where she labored until her death. Her last public work was the reconciliation of the papacy with the Roman people. She was given, it was said, extraordinary tokens of favor by Christ, whose stigmata were imprinted upon her body. She wrote devotional pieces, letters, and poems. In 1461 she was canonized. Her festival falls on April 30. (3) **SAINT CATHERINE OF BOLOGNA**, abbess of the Order of Poor Clares: b. Bologna, Italy, 1413; d. there, 1463. She founded the Poor Clares' Convent of the Holy Sacrament at Bologna. Pope Benedict XIII canonized her. Her festival is on March 9. (4) **SAINT CATHERINE OF SWEDEN**, Swedish religious: b. about 1330; d. March 24, 1381. She was the daughter of St. Bridget (q.v.) and Ulf Gudmarsson. In 1373 she succeeded her mother as abbess of the convent of the Order of the Brigidines at Vadstena. Her festival is commemorated on March 22. (5) **SAINT CATHERINE OF GENOA**, an Italian mystic: b. Genoa, Italy, 1447; d. there, Sept. 14, 1510. A member of the noble family of Fieschi, she devoted her life to work among the sick and poor, notably during the plague epidemics at Genoa in 1497 and 1501. She was canonized in 1737. Her festival is on July 22. (6) **SAINT CATHERINE OF RICCI**, an Italian nun: b. Florence, Italy, April 23, 1552; d. there, Feb. 2, 1590. She entered the Dominican Order at Prato in Toscana, and became its prioress. Her wisdom made her widely known. She was canonized in 1746. Her festival occurs on February 13.

CATHERINE I (Russian, **EKATERINA ALEKSEEVNA**; original name, **MARFA SKAVRONSKAYA**), empress of Russia; b. near Dorpat (Tartu), Livonia (Estonia), (?) April 15, 1684; d. St. Petersburg (later Leningrad), May 17, 1727. She was the daughter of a peasant who died when she was a small child. Reared as a foundling at Marienburg by a clergyman named Glück, Marfa was instructed in the Lutheran religion. There she was married to a Swedish dragoon, who abandoned her when the Swedes evacuated Marienburg in 1702. When the Russians entered the city she fell into the hands of General Sheremetiev, who relinquished her to Prince Aleksandr Danilovich Menshikov. At the latter's house in Moscow Marfa was first seen by Peter the Great, who made her his mistress in 1703. Although illiterate, she had exceptional good sense, patience, and good nature. In 1708 and 1709 she bore the emperor the Princesses Anna (d. 1728) and Elizabeth, the first of whom became the wife of Charles Frederick of Holstein-Gottorp (and the mother of Emperor Peter III);

and the second became empress of Russia in 1741. Marfa was received into the Greek Orthodox Church in 1710 and rechristened as Ekaterina Alekseevna, and in 1711 Peter the Great, having divorced Eudoxia, his first wife, married her. Besides the daughters named above, she bore the emperor five more children, all of whom died early; the Princesses Anna and Elizabeth were declared legitimate. After marriage, Catherine was the companion of the emperor on most of his campaigns. When Peter, with his army, seemed irreparably lost on the Pruth in 1711, she saved his life and extricated his forces by bribing the leaders of their Turkish adversaries with her jewels. Afterward she received many proofs of the gratitude of her husband. In 1722 she was proclaimed his successor, and in 1724, in an impressive ceremony in the cathedral at Moscow, she was crowned empress consort. Later in 1724, however, she fell under the emperor's displeasure because of a too intimate relationship with Moens, the chamberlain of her household. Peter had the man decapitated and the severed head placed in her apartments as a warning. Menshikov had continued to manifest much attachment to her; and though he had been for some time viewed with disfavor by the emperor Catherine appealed to him for aid when her husband had recurrent attacks of illness, with intervals only marked by dreadful explosions of rage. With the aid of others a reconciliation with Peter was effected, and the empress and the favorite were laboring to strengthen their improving prospects when her husband died on Jan. 28, 1725. Catherine and Menshikov, together with their supporters, considered it necessary to keep the death of the emperor secret until, by judicious arrangements, they had ensured that succession to the throne would actually pass to the empress. Theophanes, archbishop of Plescow, swore before the people and troops that Peter, on his death bed, had declared Catherine alone worthy to succeed him in the governing of the country. She was then proclaimed empress and autocrat of all the Russias, and the oath of allegiance to her was taken anew. During her short reign Menshikov was her principal counsellor. Nevertheless she desired to curb his power, and to this end established a supreme privy council in which a leading figure was Count Pëtr Andreevich Tolstoi. In foreign affairs she relied largely upon the guidance of Count Andrei Ivanovich Ostermann, one of Peter's most able diplomats. The Russian Academy of Sciences was founded with her approval and support.

CATHERINE II or **CATHERINE THE GREAT** (Russian, EKATERINA ALEKSEEVNA; original name, Anglicized, SOPHIA AUGUSTA FREDERICA OF ANHALT-ZERBST), empress of Russia: b. Stettin, Prussia (later Szczecin, Poland), May 2, 1729; d. Saint Petersburg (later Leningrad), Nov. 17, 1796. Member of a petty German princely house, at the age of 15 she was taken to Russia by her mother, Johanna Elizabeth of Holstein-Gottorp, at the request of Empress Elizabeth, to be affianced to the Grand Duke Peter, the latter's nephew and designated heir. Her faith was changed from the Lutheran to the Greek Orthodox, and on Sept. 1, 1745, the marriage was celebrated at Saint Petersburg. The union was not a happy one, for Peter was mentally weak and she was endowed with uncommon strength of character. The ardor of her

temperament and the ill treatment of her vicious husband led her into errors which had the most injurious influence on her whole political life. The couple became estranged, and much scandal was associated with her at the imperial court because of her numerous lovers. With the death of the Empress Elizabeth in January 1762 Catherine's husband ascended the throne as Peter III. He lived in the greatest dissipation, and on such intimate terms with a lady of the court that it was generally thought that he would repudiate Catherine and marry his mistress. Catherine, at the same time, condoned his infidelities since he did not oppose her own love affairs. Because of Peter's irrational conduct there was a conspiracy among certain nobles to depose him, and to this plot Catherine gave her support. Count Grigori Grigorievich Orlov, Catherine's chief paramour, and his three brothers were leaders in the movement to place her on the throne, and through their influence the regiments of the guard were the first to swear allegiance to the empress when she presented herself to them at Peterhof on the morning of July 9, 1762. Peter was seized with his wife's connivance, and, having formally abdicated, he was taken in custody to the castle at Ropsha; there, a week later, he died under unexplained circumstances, though Aleksei Grigorievich Orlov, his chief custodian, is believed to have strangled him. Thereupon Catherine was proclaimed empress and was crowned at Moscow with great pomp. During her reign of 34 years Russia was greatly enlarged and her power strengthened. In 1767 the empress assembled in Moscow deputies from all the provinces to draft an advanced code of laws, but discord soon arose and the project had to be abandoned the next year. A Cossack adventurer named Emelyan Ivanovich Pugachev proclaimed himself Peter III in 1773 and excited a revolt in several provinces of eastern Russia, but the movement collapsed following his capture on Sept. 14, 1774. The empress directed her own foreign policy and, although German by birth, identified herself completely with the interests of Russia. Through her influence Stanislas II Augustus was made king of Poland in 1764, but that country's condition became anarchic and she joined with Austria and Prussia in effecting the three partitions of that country (1772, 1793, and 1795). Her armies waged war against the Turks from 1768 to 1772, and by the Treaty of Küchük Kainarja Russia gained free navigation of the Black Sea. Grigori Aleksandrovich Potëmkin, who had become Catherine's chief favorite in 1771, conquered the Crimea in 1784 and commanded the forces which, from 1787 to 1791, waged a second victorious war against Turkey. The Treaty of Jassy, concluded in 1792, still further strengthened Russia's might.

Catherine II has been equally censured and praised. With all the weakness of her sex, and with a love of pleasure carried to licentiousness, she combined the firmness and talent of a powerful sovereign. Two passions were predominant with her until her death—love and ambition. She was never without her favorite, yet she never lost sight of her dignity. She was distinguished for her activity, working with her ministers, writing letters to Voltaire and Denis Diderot, and signing an order to attack the Turks or to occupy Poland, in the same breath. She favored distinguished authors, and was particularly partial to the French. Baron Melchior von Grimm,

her literary agent at Paris, was sheltered by her in Saint Petersburg when driven from France in 1792 by the Revolution. She several times invited Voltaire to her court; and she proposed to Jean Le Rond d'Alembert that he finish the *Encyclopédie* at Saint Petersburg and undertake the education of the grand duke—her son by Peter III. Diderot visited her at her request, and she often allowed him the privilege of familiar conversation with her. By these means she gained the favor of the literati of Europe, who called her the greatest of rulers. In fact, she was not without claims to this title. She protected commerce, improved the laws, dug canals, and founded towns, hospitals, and colleges. Peter Simon Pallas and other naturalists and travelers visited Russia at her expense. She endeavored to put a stop to the abuses which had crept into the administration of the various departments of government; but she began without being able to finish. Her anxiety to enlighten her subjects ceased when she began to entertain the idea that the French Revolution had been brought about by the progress of civilization. Despite her good intentions, there is no doubt that at her death serfdom and general misery had increased in Russia. Her son succeeded her as Paul I.

CATHERINE DE MEDICIS, kà-trên' dē mā-dē-sēs' (Italian CATERINA DE' MEDICI), queen regent of France: b. Florence, Italy, April 13, 1519; d. Blois, France, Jan. 5, 1589. She was the only daughter of Lorenzo de' Medici, Duke of Urbino, and the niece of Pope Clement VII. The latter arranged her marriage in 1533 at Marseilles to Henry, second son of Francis I of France. Three of their four sons became kings of France in her own lifetime, and two of her five daughters married ruling monarchs. At the French court she flattered alike the Duchesse d'Etampes, her father-in-law's mistress, and Diane de Poitiers, the mistress of her own husband, though these two ladies hated each other. With the accession of her husband as Henry II in 1547 her influence was eclipsed by that of his mistress; and when her eldest son came to the throne in 1559 as Francis II her authority was surpassed by that of his uncles, François de Lorraine, Duc de Guise, and Charles, Cardinal of Lorraine. Her second son was still a minor on becoming king as Charles IX in 1560, and as regent during the next three years she was actual ruler of the kingdom. After he came of age in 1563 he continued completely under her domination, and her influence remained undiminished throughout his reign. Her policy was to secure the welfare of her family and preserve the unity of France, and to this end she labored to keep the balance between the Huguenots and the Guises. Wavering between the Guises on the one side, who had put themselves at the head of the Roman Catholics, and Louis I de Bourbon, Prince de Condé, and Gaspard de Coligny, the powerful leaders of the Huguenots, she was constantly obliged to resort to intrigues. She insured toleration for the Huguenots by the edict of January 1562; but when they seemed too powerful she ordered the assassination of Coligny and, when this failed, sanctioned the Massacre of Saint Bartholomew (see BARTHOLOMEW, SAINT, MASSACRE OF). With the death of Charles in 1574, her third son, who had been elected king of Poland the preceding year, became, in turn, king of France as Henry III. Despite the designs of her fourth son,

Francis, Duc d'Alençon (who became Duc d'Anjou), she continued to exert considerable influence at the French court. At her death France was in a state of complete dismemberment. Her manners were elegant, and she took a lively interest in the sciences and arts. She procured valuable manuscripts from Italy and Greece, and caused the Tuileries and the Hôtel de Soissons to be built. In the provinces, also, several castles were erected by her order, distinguished for the beauty of their architecture, in an age when the principles of the art were still unknown in France. Her daughter Elizabeth of Valois was married in 1560 to Philip II of Spain; and in 1572 her daughter Margaret of Valois became the wife of Henry III of Navarre (who ascended the French throne as Henry IV in 1589).

CATHERINE HOWARD. See HOWARD, KATHERINE (CATHERINE).

CATHERINE OF ALEXANDRIA. See CATHERINE, SAINT.

CATHERINE OF ARAGON, ār'a-gōn, first consort of Henry VIII of England: b. Alcala de Henares, Spain, Dec. 15, 1485; d. Kimbolton, Huntingdonshire, Jan. 7, 1536. The youngest daughter of Ferdinand and Isabella of Spain, in 1500 she was betrothed to Arthur, Prince of Wales, son of Henry VII, and she was married to him at Saint Paul's Cathedral, London, on Nov. 14, 1501. The prince died April 2, 1502, and a papal dispensation was obtained for her betrothal to the king's second son, Henry, now prince of Wales and heir apparent to the English throne. It was not until the latter's accession to the throne as Henry VIII that the marriage was celebrated, June 11, 1509, and she was crowned with her husband at Westminster Abbey 13 days later. He was then 18 years old and his queen 23, and this inequality of their ages and the capricious disposition of Henry were circumstances most adverse to the durability of their union; in fact, it seems surprising that Catherine should have acquired and retained an ascendancy over the affections of the king for nearly 20 years. The only one of their five children to survive was Mary (who became Mary I), and the lack of male issue proved a source of disquietude to him. Moreover, he wanted Anne Boleyn for his wife. She served as regent during the king's invasion of France in 1513, and she visited France with Henry in 1520, when the monarch met Francis I at the Field of the Cloth of Gold (q.v.). In 1526 Henry refused further cohabitation with her on the grounds that his marriage with his brother's widow was invalid, and in 1528 Cardinal Lorenzo Campeggio, Italian papal legate, was appointed by Pope Clement VII colleague with Cardinal Thomas Wolsey to hear Henry's suit for divorce. On June 21, 1529, during the court hearing in London, Catherine appealed to her husband in person before the colleagues, denying the court's jurisdiction and asking that the matter be referred to Rome. Campeggio subsequently adjourned the court, and the papal refusal of the appeal made to it caused the downfall of Wolsey and provoked Henry to create a national church separate from the Roman Catholic Church. On July 14, 1531, at Windsor, Henry finally left Catherine, who was separated from her daughter, Mary. Thomas Cranmer, archbishop of Canterbury, declared in 1533 that

her marriage to Henry was null and void; and with the king's marriage to Anne Boleyn, Catherine, no longer considered queen consort, was compelled to spend the rest of her life in close confinement. On March 23, 1534, Rome at last declared the marriage of Catherine and Henry to be valid, and to the end the queen refused to acknowledge her deposition. Her last years, spent in solitude at Buckden and Kimbolton, in Huntingdonshire, were occupied chiefly in prayer and needlework. Shortly before her death she wrote a letter to the king, recommending their daughter to his protection, praying for the salvation of his soul, and assuring him of her forgiveness and unabated affection. The pathos of this epistle is said to have drawn tears from Henry. He had never presumed to call the virtues of his injured wife in question, and she certainly acted throughout with eminent dignity and consistency. She was buried in Peterborough Cathedral.

CATHERINE OF BOLOGNA. See CATHERINE, SAINT.

CATHERINE OF BRAGANZA, brā-gān'zā, consort of Charles II of England: b. Villa Vicosia, Portugal, Nov. 25, 1638; d. Portugal, Dec. 31, 1705. The daughter of John IV, Duke of Braganza (king of Portugal from 1640), she was married to Charles II in London on May 21, 1662; her dowry included cession of Tangier and Bombay to England. She showed at first a natural resentment at the infidelities of Charles, but finding her bitter protests of no avail, she began to tolerate his mistresses—notably Lady Castlemaine and the Duchess of Portsmouth. As a Roman Catholic, she was viewed with suspicion. When Titus Oates (q.v.) was active she was accused of attempting to poison the king: Charles, however, stood by her and the danger passed away. The queen survived the death of her husband in 1685 and remained in England until 1692, when she departed for Portugal. During 1704-1705 she was regent for her brother, Peter II of Portugal, whose increasing infirmities rendered retirement necessary. In this position she showed considerable astuteness, carrying on the war against Spain with firmness and success.

CATHERINE OF GENOA. See CATHERINE, SAINT.

CATHERINE OF RICCI. See CATHERINE, SAINT.

CATHERINE OF SIENA. See CATHERINE, SAINT.

CATHERINE OF SWEDEN. See CATHERINE, SAINT.

CATHERINE OF VALOIS, vā-lwá', consort of Henry V of England: b. Paris, Oct. 27, 1401; d. Bermondsey, Jan. 3, 1437. She was the youngest child of Charles VI of France and Isabeau (Isabella) of Bavaria. In 1420 she was married to Henry at Troyes, and the next year she was crowned in Westminster Abbey. Their son became Henry VI. After Henry's death in 1422 she came under the influence of Owen Tudor, squire of an old Welsh family; an act passed in 1428 forbidding marriage with the queen mother without royal consent was apparently too late. She bore him a daughter and

three sons; Edmund, the eldest, became the father of Henry VII. After Tudor's imprisonment in 1436 Catherine withdrew to Bermondsey Abbey, near London.

CATHERINE PARR. See PARR, CATHERINE.

CATHERINE WHEEL, a window or compartment of a window of circular form, sometimes with radiating divisions or spokes, used in medieval buildings, called a rose, or marigold window. It is a memorial of Saint Catherine's martyrdom. The term is also applied to a kind of firework in the shape of a wheel, made to revolve automatically when lighted; a pin wheel.

CATHERWOOD, Mary Hartwell, American novelist: b. Luray, Ohio, Dec. 16, 1847; d. Dec. 26, 1902. She taught school prior to her marriage in 1877 to James Steele Catherwood. Her first book, *Cracque o' Doom*, appeared in 1881. Among her novels of French Canadian life were *The Romance of Dollard* (1889); *The Story of Tonti*; and *The Lady of Fort St. John*. Stories of the Middle West included *Old Kaskaskia* (1893) and *The Spirit of an Illinois Town* (1897). She also wrote historical works, among them *The Days of Jeanne d'Arc* (1897) and *Heroes of the Middle West* (1898).

CATHETER, kăth'ê-tēr, in medicine, a tubular instrument used to insert into a mucous canal or hollow organ, such as eustachian catheters for the internal ear, urinary catheters for the bladder, and nasal catheters for the nose.

CATHETOMETER, kăth-ê-tôm'ê-tēr, in physics, an instrument for the exact measurement of small vertical distances. Its usual form consists of a horizontal telescope which slides upon a fixed, graduated, upright post. The telescope is raised or lowered until its cross hairs coincide with one of the objects whose difference in height is to be determined, and the position of the telescope upon the graduated post is noted by means of a micrometer. The telescope is then brought to the elevation of the second object, in the same manner, and the difference in the two readings gives the desired difference in height. A cathetometer is especially useful for the measurement of two tubes of mercury or other liquids.

CATHODE, kăth'ôd, in physics and chemistry, the negative pole (opposed to the anode, or positive pole) of any portion of an electric circuit, such as a battery, electrolytic cell, or vacuum tube.

CATHODE RAYS. See ETHER; ELECTRON THEORY; MOLECULAR THEORY; RADIATION.

CATHOLIC APOSTOLIC CHURCH, a religious body which was founded in London, Eng. in 1832 by the Rev. Edward Irving (q.v.) and frequently referred to as Irvingite. It was a vision of religious ideas rather than a distinct theology, in which the subject of prophecy was important as well as the doctrine of the second advent. Irving maintained Christ's immunity from sin but stated that the humanity which Christ assumed was sinful. In addition to the faith in prophecy by fervent prayer the gift of healing was also claimed. A religious

group came into being, and churches were opened in England, Germany, and the United States, with an elaborate, formal service of worship. Irvingites were often members of other churches also; the ministry was conducted by persons of ordinary occupations. In 1936 there were 7 churches in the United States, with a total membership of 2,577.

CATHOLIC BENEVOLENT LEGION, a fraternal society for Roman Catholic laymen, designed to afford to the members facilities for intellectual improvement, social advancement, and such other advantages as are offered by similar non-Catholic fraternities. It was organized in 1881 and incorporated under the laws of the state of New York with 11 charter members. The organization has the approval of the archbishops and bishops in whose jurisdictions councils of the fraternity have been formed.

CATHOLIC CHURCH, a phrase signifying universal church, the whole body of true believers in Christ; but the term is commonly used as equivalent to the Roman or Western Church. Like most other words used in ecclesiology, the term "Catholic" was borrowed at first from the New Testament. It occurs in some editions of the Greek original—including that issued in connection with the last revision—in the titles prefixed to the Epistles of James, I and II Peter, I John and Jude, and is the word translated general in the King James Bible. The first to apply it to the church was the Apostolic Father, Ignatius of Antioch (q.v.). When he and his successors used it they meant to indicate that the church of which they constituted a part comprised the main body of believers, and was designed, as it was entitled, to be universal. In this sense, the church was opposed to the sects and separate bodies of heretics who had separated themselves from it and were now outside its pale. When, in the 9th century, the separation between the Eastern and Western churches took place, the latter retained as one of its appellations the term Catholic, the Eastern Church being contented with the word Orthodox, long used by the Russian emperors in their politico-ecclesiastical manifestos. When the Protestant churches separated from communion with Rome in the 16th century, those whom they had left naturally regarded them as outside the Catholic pale. They, on the other hand, declined to admit that this was the case, and the term Catholic Church is used in the English liturgy apparently in the sense of all persons making a Christian profession.

CATHOLIC CHURCH, Roman. By this name is designated the large body of Christians, united in doctrine and worship under the supreme jurisdiction of the pope, the bishop of Rome. (See PAPACY.) The members of this communion are wont rather to speak of it as the Catholic Church, but admit the term "Roman" in the sense that "to be Roman is to be Catholic and to be Catholic is to be Roman." They hold that their church alone possesses in its fullness the system of truths, laws, and practices for the worship of God which was instituted by Jesus Christ (q.v.). Hence a brief statement of Catholic teaching on the origin, nature, and properties of the Church of Christ is necessary in order to understand why

the Roman Catholic Church demands that all men submit to her authority as a teacher, divinely appointed to make known with absolute certainty the conditions of salvation.

For the convenience of the reader, this article is divided into the following sections:

1. Doctrine
2. Organization
3. History
4. Catholic Church in the United States
5. Catholic Education in the United States
6. Catholic Press in the United States
7. Catholic Church and Science

1. DOCTRINE. From the four Gospels, considered as trustworthy historical documents, we learn that Jesus Christ was certainly a divine messenger to all mankind, and that therefore all men are bound to receive His message with implicit submission. The doctrine which He teaches may be an enforcement of truths which man might have learned, however imperfectly, by the use of his natural powers, or may include new truths which his natural powers would never have discovered.

The Apostles.—As Christ did not remain on earth to teach all men in person, He chose a band of apostles, whom He commissioned to preach to all nations the truths He had taught them, promising His assistance unto the end of the world, and imposing upon all men, under penalty of losing their souls, the obligation of receiving His doctrine. The presence of the Holy Spirit was to preserve the apostles from error and keep them perfectly united in their teaching.

Besides the gift of infallibility (q.v.), He conferred on them jurisdiction over all believers, the right to govern with threefold power, legislative, judicial, and executive. Moreover, they were to sanctify men by certain religious rites, called sacraments (q.v.), and for this purpose received the gift of holy orders (q.v.). To Peter (see SAINT PETER), one of the 12 apostles was granted a primacy, not merely of honor, but of jurisdiction. On him was Christ's Church to be built; he was to feed the entire flock, the lambs and the sheep. By thus organizing a body to teach, govern, and sanctify men under the primacy of St. Peter, Christ founded a religious society, supernatural in aims and means, and He chose for it the special name, the Church. (See CHURCH.)

This society was to last even unto the day of judgment; its duty was to teach all men; wherefore the apostles appointed their successors and transmitted to them the authority received from Christ. As the primacy of St. Peter was the first foundation, necessary to ensure the unity and stability of the church, it too was to last forever. The power he received was for him and his successors. There never should come a time when the doctrine of Christ would be lost through corruption.

Christ's Church.—Whence we gather that there exists today a religious society, empowered to teach with certainty all the truths of Christianity, and that it is a visible body, united in its government and religious teachings. The members of this society submit to its infallible teaching by profession of the faith, to its sacred ministry by the reception of baptism (q.v.), and to its ecclesiastical rule by obedience. If all men are obliged to enter this society, it is evident that Christ provided some signs, notes or marks by which His church can become known to all

earnest inquirers, by which it can be distinguished from other associations. Christ intended that His church should be known by unity. It was to be one in faith, one in government, one in worship, and one in the charity uniting all its members. It was to be known by holiness. The church is holy in its Founder; in its aim to lead men to God; in its means of sanctification, in the heroic virtue of many members, and in the permanence of miracles among them. It was to be catholic; that is, conspicuously diffused everywhere. Finally it was to be apostolic. The governing and teaching body is the continuation of the apostolic body to which Christ gave His mission and with which He promised to remain until the end of time. Whoever is not in communion with the successor of St. Peter cannot possess union with the apostolic body. The obligation of becoming a member of the church is often expressed in these words: "Out of the Church, there is no salvation." They do not mean that all who die out of the visible communion are lost. God does not inflict punishment but for a willful fault, and those who without fault cannot see their obligation of joining the church are not to blame. If, however, anyone, knowing this obligation, refuses to comply with it, he puts himself out of the way of salvation. The same holds true for those who neglect to examine properly into a matter of so great importance.

Catholics hold that the marks of the true Church of Christ are found only in the church in which the bishop of Rome holds the primacy. The bishops of this church all over the world are the successors of the apostles, possessing the right to teach, to rule, and to sanctify. The gift of infallibility, that is, the right to declare that certain doctrines have been revealed by God, is not personal to each bishop, but belongs only to the whole body of bishops, whether gathered in general council or not. The consent of the universal church, according to Christ's promise, is a sure criterion of revelation. To the bishop of Rome, as the successor of St. Peter, belongs the primacy of jurisdiction over the whole church, complete, supreme, ordinary, and immediate over each and all the churches of the world, over each and all the bishops and the faithful.

Papal Authority.—In this primacy is included the supreme authority as teacher of the church, or the prerogative of papal infallibility. By virtue of a special supernatural assistance of the Holy Spirit promised to St. Peter and his successors, the pope cannot err when, as supreme teacher of the universal church, he defines a doctrine concerning faith or morals to be held by the whole body of the faithful. Only when these four conditions are fulfilled is the pope infallible: (1) he must speak not in his private capacity, not merely in his official character, but as supreme teacher; (2) the matter defined must concern faith or morals; (3) the judgment must be delivered with the manifest intention of commanding intellectual assent; (4) the definition must be given to the whole body of the faithful. It is clear that infallibility has absolutely no connection with the pope's personal qualities and is entirely distinct from impeccability, or incapability of sinning. The extent of papal infallibility is the same as that of the church's infallibility. It embraces all the truths that God has revealed as the object of faith, and extends

to other truths and matters of faith without assurance of which it would be impossible, or very difficult, to preserve the deposit of revealed truth.

Scripture and Tradition.—It follows from what we have hitherto said that whoever wishes to know Christ's doctrine must appeal to the living authority. The church as teacher, that is, the bishops now living in union with the pope, can alone tell us what doctrines were revealed. This knowledge is not acquired from new revelations, but with the assistance of the Holy Ghost (q.v.) from various sources, chief among which is the preaching of the Gospel, by which the doctrines of Christ are handed down as a sacred heritage from age to age. Thus, even if nothing had ever been written, we should have today, incorrupt and infallible, the means of preserving religious truth which Christ established, namely tradition. However, it was natural that those who were commissioned to teach should also set down their teaching in writing. Hence we possess many documents and monuments from which we learn what the church taught in past ages and what it now teaches; the truths revealed remain unchanged. Moreover, we learn from the church that God Himself provided, by means of men, certain writings, containing revealed truth, and gave them to the church for the instruction and direction of the faithful. (See BIBLE.) From it alone we learn what books have been so inspired and constitute Holy Scripture; the church alone can authoritatively interpret these writings. Tradition, therefore, is prior to the Christian Scriptures both in time and in thought. It is wider in its scope, for it embraces Scripture as an instrument by which tradition is handed down and, on the other hand, contains matters which are not in Scripture. First and principally, tradition teaches us the authoritative character of Scripture itself. Even were all the copies of Scripture destroyed, the living voice would still proclaim the entire Christian teaching. Catholics yield to none in their esteem of Holy Writ as the inspired word of God, but they so esteem it because of what they learn concerning it from tradition. The chief sources from which this tradition is learned are the acts of councils, the writings of the popes, of the fathers of the church, inscriptions, monuments, pictures, liturgies, rites, and pious customs, in a word, every way in which the church is wont to profess her faith. See also APOSTOLIC FATHERS; FATHERS OF THE CHURCH; TRADITION.

Chief Doctrines of the Catholic Faith.—Catholics believe in one, true, living God, the Creator and Lord of heaven and earth and of all things visible and invisible, almighty, eternal, immense, and incomprehensible; infinite in will and intellect, and in all perfection, who, being one, singular, absolutely simple and unchangeable spiritual substance is to be regarded as distinct really and in essence from the world, infinitely happy in and from Himself, and unspeakably elevated above all things that exist or can be conceived. He knows all things in the most perfect manner, by one all-embracing act of His intellect, from eternity to eternity ever the same. He knows his own being, all things that are possible, past, present, and future, and all things that are not and never have been nor will be, but which would be, if some condition were fulfilled. He is all-wise, all-holy, all-just, true, faithful, and bountiful. Moreover, in God as there is one divine nature, so there are three divine persons, Father, Son,

and Holy Ghost, really distinct from one another, perfectly equal to one another. Nevertheless there are not three Gods, but one God. The Father is unbegotten, the Son is begotten of the Father, and the Holy Ghost proceeds from the Father and the Son. (See also TRINITY, DOCTRINE OF THE). This one true God of His goodness and by His omnipotent power, not in order to increase His happiness, not to acquire perfection, but to manifest it by the good which He imparts to His creatures, in accordance with His absolutely free decree, at once from the beginning of time framed out of nothing as to the whole of their substance, two kinds of creatures, spiritual and material, the angels and the world, and then man, in whom spirit and matter were united. God preserves and governs by His providence all things that He has created.

To the angels He gave sanctifying grace and with it the power to merit eternal happiness by free service. Many of them rebelled and were cast into everlasting fire, the rest were confirmed in grace and admitted to the beatific vision of God "formed the body of the first man out of the slime of the earth." He created his soul immediately, as He creates the soul of every man; the soul is a spirit, endowed with intellect and free will, and immortal. All men are descended from Adam (q.v.) and Eve. Like the angels, our first parents were also raised to a supernatural state by the infusion of sanctifying grace into their souls, being made adopted children of God, destined to the enjoyment of the beatific vision. This is the principle of supernatural life, whereby man can produce works that merit a heavenly reward. Moreover, God bestowed on man other preternatural gifts: great powers of mind and infused knowledge, complete control of the passions, immortality, and exemption from suffering and decay. This original justice our first parents lost by mortal sin, that is, by a grievous, willful violation of God's law; in consequence of Adam's sin all of his descendants are deprived of those privileges, are conceived in original sin and cannot of themselves enter the kingdom of heaven.

To atone adequately for the grievous insult to God and to repair the evil done to mankind, the second person of the Trinity became man. Jesus is true God and true man, one Divine Person subsisting in two natures, divine and human, not by the conversion of divinity into flesh, but by the assumption of humanity unto God. He was born of the Virgin Mary, who was truly the mother of God and remained a virgin in conceiving and bearing her divine Son and ever after till the end of her life. By singular privilege of God through the merits of Christ, the Redeemer, the Blessed Virgin was preserved free from original sin (q.v.), that is, in the first moment of her conception, when her soul was created, it was endowed with sanctifying grace. By further privilege, she was never guilty of any actual sin, mortal or venial. See also MARY; IMMACULATE CONCEPTION.

Christ, the God-man, became our Redeemer not by the mere effect of His preaching and example, but by His bloody death on the cross. He made Himself our mediator with His Father, offering atonement for the sins of all men. This satisfaction is not applied to those who have use of reason without their free employment of the means ordained by Christ. He merited for us the remission of sins, sanctifying grace, and all other graces conferred on man. After His death. He rose again on the

third day, ascended into heaven, where He sits at the right hand of the Father, whence He shall come with glory to judge the living and the dead, and of His kingdom there shall be no end. He founded a church and confided to it the task of teaching His doctrines and applying to men's souls the means of sanctification. This church is the guardian and interpreter of revelation; for though the existence of God can be known with certainty by the light of reason, it has pleased the Divine Wisdom to reveal many natural truths, as well as all those regarding our supernatural life. This revelation is contained both in written books and in unwritten traditions. The books of the Old and New Testament, held by the church to be sacred and canonical, were written by the inspiration of the Holy Ghost and have God as their author. In matters of faith and morals, the true meaning of Scripture is that which is maintained by the church. All interpretations at variance with the unanimous consent of the fathers, when they speak as witnesses of tradition, are false and forbidden.

Whatever is presented to us by the church as revealed truth must be accepted by the free assent of the intellect, not because of its intrinsic truth seen by the light of reason, but on the authority of God who has given the revelation, and who can neither be deceived nor deceive. This divine revelation has been made credible by external proofs, especially by miracles and prophecies; yet as faith is a supernatural virtue, the act of faith requires the assistance of divine grace, enlightening the intellect and strengthening the will and making our act supernatural. Without faith there is no justification, but as God wishes all men to be saved, all receive, either proximately or remotely, the grace to believe. Among revealed truths some are mysteries that cannot be demonstrated by human reason, but must be believed. The demonstrations of reason cannot contradict revelation, hence any assertions of human science that are at variance with what the church teaches to be revealed must be false.

As grace is necessary for the beginnings of faith and even for the pious affection toward believing, so it is needed to make our good works deserving of a supernatural reward. Grace is needed even for the just to avoid sin. Final perseverance is a special privilege of dying in the state of grace. Apart from a special revelation, no one can know that he will receive this blessing. Without grace, however, it is possible to resist less urgent temptations and perform acts that have natural goodness; hence all works done before justification are not sins. According to Catholic doctrine, actual grace is a real influence exerted by the Holy Ghost upon the soul, but it does not destroy the free will of man. A grace may be fully sufficient for a supernaturally good act, but if a man refuses to act with it, the grace will not be efficacious. God will not save us without our cooperation. See also GRACE OF GOD.

Actual graces aid us to obtain habitual or sanctifying grace, that is, to be justified by the remission of original sin or of grievous actual sin. This sanctifying grace makes us like unto Christ, holy and supernaturally pleasing to God, and brings with it the infused virtues and the gifts of the Holy Ghost. There are many

grades of habitual grace; it may be increased by good works and, on the other hand, may be entirely lost by mortal sin. God in His mercy offers to man supernatural happiness and makes this offer known by the preaching of His church, which he accompanies by an interior stirring grace. When a man cooperates with this grace, he believes the truth with absolute certainty and is moved by the thought of God's love; he sees reasons to fear God's justice and throws himself on God's mercy, trusting in the merits of Christ; hence he conceives a love of God and a detestation of sin. Thus by the working of grace and the cooperation of man's free will, the way is prepared for justification; and, provided that man puts forth no obstacle, the Holy Ghost works this justification by infusing charity into his soul, thereby destroying sin. Thus purified, man enters on a virtuous life, hoping by the merits of Christ to enter heaven, but he has no absolute certainty of his salvation.

In the process of justification, the first grace cannot be merited at all; for no supernatural reward is due to natural acts. With the aid of grace, both sinners and just can merit further actual grace, but only congruously and not with any strict right in justice. The just, that is, those in a state of grace, can merit final perseverance congruously and, because of God's promises, can merit in justice the increase of habitual grace, eternal life, and increase of glory. By mortal sin, all merit is lost.

As a means of justification, Christ has entrusted to His church seven sacraments (q.v.), or sensible rites, instituted by Him to effect in the soul the grace which they signify. When the necessary conditions are placed, the sacrament works by its own efficacy and not through the piety of the minister nor of the recipient. The sacraments are baptism, confirmation, Holy Eucharist, penance, extreme unction, holy orders, and matrimony. Baptism and penance remit sin; the others cannot lawfully be received in mortal sin. Baptism, confirmation, and holy orders can be received only once, because they imprint on the soul an ineffaceable mark, called the sacramental character. All the sacraments, if properly received, give sanctifying grace or increase it, if already in the soul. Since the promulgation of the Gospel, justification cannot be obtained without baptism of water, which blots out original sin and all actual sin. Infants who die without baptism cannot enjoy the supernatural vision of God. In adults, when baptism of water cannot be received, pardon of sin can be obtained by the baptism of desire, which consists in a perfect love of God and a sorrow for sin, including, at least implicitly, the desire for the sacrament. Remission of sin is also granted to all who suffer martyrdom for Christ. Sins committed after baptism are remitted by the sacrament of penance (q.v.) in which the sinner confesses with contrition all his mortal sins to the duly authorized priests of the church, from whom he receives absolution. Sins are also remitted by perfect contrition, but the obligation of divine law requires that even then, if possible, they must be confessed. Penance pardons the guilt of sins confessed and repented of, infuses or increases sanctifying grace, remits eternal punishment, if it was due, secures actual graces to avoid sin in future, and may also remit, wholly or in part, the temporal punishment still to be

undergone for sins the guilt of which has been pardoned. The whole punishment is not always remitted with the fault; for the remaining debt, satisfaction is made to God by sufferings patiently borne or voluntarily inflicted. For this purpose also the church has the power of granting indulgences which are not a remission of sin, much less a permission to commit sin, but the remission of the whole or part of the temporal punishment which may be due for sins, after the guilt has been pardoned. See also *INDULGENCE*.

In the Holy Eucharist there is really and substantially present the Body and Blood, Soul and Divinity of our Lord Jesus Christ, under the appearances of bread and wine. (See also *EUCCHARIST*.) By the words of the priest at the consecration, there is effected a conversion of the whole substance of the bread into the Body and of the whole substance of the wine into the Blood, which conversion is called transubstantiation (q.v.). By force of the words, the Body is under the species of the bread and the Blood under the species of the wine, but in virtue of the natural connection and concomitance by which the parts of Christ are linked together, He exists whole and entire under each species and every part of the species. In the Mass (q.v.) there is offered to God a true, proper, and propitiatory sacrifice for the living and the dead. To offer up this sacrifice, Christ instituted a visible and external priesthood and the sacrament of holy orders (q.v.); the minister of this sacrament must be a bishop, who has received the fullness of the sacred ministry. The various orders constitute the hierarchy. Priests cannot ordain or confirm. Other orders are the diaconate, subdiaconate, and the minor orders (acolyte, exorcist, lector, and ostiary). Before the minor orders, the tonsure is conferred as a sign of enrollment among the clergy, who are separated from the rest of the faithful, called the laity. The right to exercise the sacred functions within appointed limits is called jurisdiction; it is required for the lawful performance of all functions and for the validity of some. The Roman pontiffs have, by divine institution, universal jurisdiction. The other bishops have power to govern the dioceses to which they have been assigned by the pope.

Marriage between Christians was raised by Christ to the dignity of a sacrament. Its essence lies in the contract freely made between man and wife; the grace conferred is, first, an increase of sanctity, and, second, actual grace to fulfill the duties of the married state. The bond of Christian marriage after consummation is absolutely indissoluble. It is also exclusive: no man can have several wives, no woman, several husbands, at the same time. Those who, with the aid of God's grace, fulfill the obligations of virginity or celibacy live in a state more holy and better than the state of matrimony. From the fact that Christian matrimony is a sacrament, it follows that it has been entrusted to the church and is subject to the laws of the church, not to those of the state; hence the church has the power of assigning conditions necessary for the validity or lawfulness of the contract between those who have been baptized. See also *MARRIAGE*, *THE LAW OF*.

The means of sanctification are given to men to enable them to live and die in the state of sanctifying grace. At the hour of death each soul is judged by Christ and, if in mortal sin,

is condemned to hell to be punished by eternal torments, varying in intensity according to the degree of guilt. Those who die free from all sin, mortal and venial, and from all the temporal punishment for sin, are admitted at once to life everlasting, to perfect beatitude in the vision of God. The saints and angels in heaven offer up prayers for men, and it is good and useful to invoke their intercession that we may obtain favors from God through Jesus Christ, who is our sole Redeemer and Saviour. Catholics honor and venerate the saints and angels, and especially the Blessed Virgin Mary, because God loves and honors them, and because of their own personal sanctity; not, however, with the supreme worship that belongs only to God. Because of their special connection with holy persons, honor is also given to relics of the saints, to images and paintings of Christ and His saints. If men die in venial sin, or temporal punishment be still due, their souls are detained in purgatory (q.v.) until expiation is made. In this state they can no longer merit for themselves, but can be assisted by the prayers and good works of the faithful and particularly by the holy sacrifice of the Mass. The church has the power to apply indulgences for their relief. In addition to the particular judgment, immediately after death, there will be a general judgment at the end of the world. The body will rise from the grave reunited to the soul, and share for eternity either happiness in heaven or punishment in hell.

The chief duties of Christian life are expressed in the Ten Commandments of God and the commandments of the church. Many laws have been imposed by the church on particular classes or for special purposes; all Catholics, however, are bound, under pain of mortal sin, to hear Mass and rest from servile work on Sundays and holydays of obligation, to fast and to abstain from certain food on the days appointed, to confess all mortal sins at least once a year, and to receive the Holy Eucharist during the Easter time.

A Catholic must believe all the truths God has revealed and teaches through His church. Denial of one such would mean either the denial of God's veracity or of the church's infallibility. But it is not necessary that he should know explicitly more than the principal truths; all others are included in his acceptance of the church as a divine teacher, alone capable of declaring what truths are contained in the *deposit of faith* handed down from the apostles. The definition of a dogma by the church brings no change in doctrine; for no truth once taught as of faith is ever given up nor can any point be added which was not contained, at least implicitly, in the original teaching. However, the church's infallibility is not limited merely to revealed doctrines; she can also speak infallibly on matters necessary to safeguard revealed teaching. Belief in such decisions is called ecclesiastical faith. Outside the domain of divine or ecclesiastical faith, there are many subjects of pious belief among Catholics. Some of these may perhaps belong to the deposit of faith, but they are not yet authoritatively proposed. Others depend on human testimony, and are accepted with that degree of certitude which the testimony warrants.

In the expression of revealed truths and in the defense of faith from the charge of conflict

with demonstrated truths of science and philosophy, the church makes use of terms derived from the philosophy current among its subjects. Thus it has come about that the dogmas are expressed in the terms of scholastic philosophy and officially in the Latin language. As its doctrines can be taught in any language, so, too, the expression of them may be harmonized with whatever is found to be true in any system of philosophy.

In the worship, liturgies, discipline, and practices of the church, some regulations may be of divine origin, others are of ecclesiastical origin, and still others arise from the voluntary piety of individuals. Besides the ordinary obligations of Christian life, the church invites those of her children who feel the call from God to bind themselves by vow to His service. The principal vows are those taken to observe the evangelical counsels of poverty, chastity, and obedience. Those who have thus bound themselves in approved congregations or religious orders are called *religious*. (See ORDERS, RELIGIOUS). As a matter of discipline, all those in sacred orders in the Latin portion of the church are bound to observe celibacy. In the Greek portion today, no priest can marry, but married men may receive holy orders, except episcopal consecration.

2. ORGANIZATION. Supreme jurisdiction resides in the pope; the bishops are the rulers of dioceses, which are subdivided into parishes or missions under a parish priest or rector, assisted by curates. The dioceses are united into provinces, over each of which is an archbishop or metropolitan, the other bishops being called his suffragans. The archbishop convokes provincial synods (q.v.) hears certain appeals from the episcopal court, watches over the observance of ecclesiastical law in some particulars, and, under certain circumstances, appoints an administrator when a suffragan dies. The rank of patriarch is now only honorary. The pope is represented in some countries by apostolic delegates, to whom are referred appeals from the lower courts and through whom the pope sends his communications. In some countries there are apostolic nuncios, who deal directly with the various governments that have their representatives at Rome.

The pope is assisted immediately by the sacred college of cardinals and by the sacred congregations. The college of cardinals, when complete, contains 70 members: 6 cardinal bishops of the suburban sees, 50 cardinal priests, and 14 cardinal deacons. The sacred congregations, 12 in number, are committees of cardinals to whom special affairs are entrusted. They were arranged almost as at present, by Pope Sixtus V. The cardinals alone cast votes for the final decisions, but they are assisted by secretaries and consultors. The pope himself acts as prefect of some congregations (the Holy Office, the Oriental Church and the Consistorial). A cardinal presides over each of the others. The acts of all congregations are submitted to the pope for his approval. These acts, unless promulgated in a solemn manner as the acts of the sovereign pontiff himself, are subject to change; though not infallible, they must be received by the faithful with an internal assent, such as is due to religious authority and obeyed as laws of the church. The more important congregations are: the Holy Office (the

supreme tribunal to guard the teaching of faith and morals), the Consistorial (which selects the matters that are presented and sanctioned by the college of cardinals assembled in the papal consistories), the Congregation for the Oriental Church, and the Congregation *De Propaganda Fide* (which cares for missionary countries), the Congregation of Sacred Rites, the Congregation of the Council, to which is committed the universal discipline of the secular clergy and the Christian people, and the Congregation for Extraordinary Ecclesiastical Affairs. See also CANON LAW.

The Church and Civil Authority.—The church was established by Christ as a perfect, independent religious society. Its authority depends on God's ordinances alone; wherefore it has always denied any right on the part of the state to interfere in its internal affairs. In Catholic countries, the church claims immunity for its officials from the authority of civil tribunals; in past ages this immunity was often absolutely necessary for their just protection. Sometimes the pope makes a concordat with temporal rulers; that is, a treaty whereby, in consideration of certain promises of these rulers, the pope abstains from urging certain of his rights. To exercise the prerogatives which we have described, the pope, his cardinals, and other officials must be exempt from the jurisdiction of any civil tribunals. Practically this cannot be secured without the temporal power (q.v.), or better, the temporal independence of the sovereign pontiff. It is not enough for the pope to be free, he must be known to be free; suspicion of being under the influence of a sovereign would be fatal to his influence. This independence he possessed for more than 15 centuries; it was assured by the recognition of his sovereign authority in the states of the church. From the annexation of these states by the Italian government in 1870 to the conclusion of the Lateran Treaty in 1929, by which an independent Vatican City with the pope at its head was set up, the popes proclaimed the seizure of the states of the church an act of injustice; that the pope did not possess the freedom, security, and independence necessary for the proper exercise of his authority; that the Holy See must insist on these facts and look forward to some efficient remedy. To deal rightly with Catholics of all nations, the pope must be extranational. As the seat of the United States federal government, the District of Columbia, is independent of all the states, so the seat of the general government of the church should be independent of all the countries of the earth.

3. HISTORY. The history of the Roman Catholic Church may be divided into three great epochs: (1) Christian antiquity, embracing the first seven centuries, during which Christian civilization was chiefly Greek and Roman, (2) the Middle Ages, from the 8th century to the 16th, characterized by the church's action among the various peoples of north and central Europe, who were molded into organized nations by her influence; (3) the modern age, from the rise of Protestantism to the present day, during which the Germanic nations separated from the church and attached themselves to various sects, and the church has had to struggle against the modern, infidel spirit in science and government.

The first epoch contains two periods. First comes an era of persecution, during the struggle

with paganism, which was terminated by the Edict of Milan (313); then, an era of development in definitions of dogma against the attacks of heresy. The second epoch embraces four periods: (1) the conversion of the barbarians; (2) the development of the Western Empire and the church's struggle to maintain her independence (800–1073); (3) the supremacy of the church maintained (1073–1300); (4) attacks on the church's supremacy, from Boniface VIII to Protestantism.

During the third epoch three periods may be distinguished: (1) the period of religious warfare, ending with the Treaty of Westphalia, 1648; (2) from 1648 to the French Revolution, the era of established churches; (3) down to the present day: neopaganism in science and life, the age of unrestrained freedom to accept or deny the truths of religion.

Even while the church was undergoing cruel persecution, she was also developing her discipline and defending her doctrines against the pagans and heretics. From the first three centuries have come down to us the valuable works of Ignatius of Antioch, Polycarp, Justin, Clement of Alexandria, Origen, Tertullian, Cyprian (q.v.), and many others. The mightier struggle with heresy, and her marvelous growth after she emerged from the catacombs, gave renown to Athanasius, Basil, the Gregories in the East and West, Chrysostom, the Cyrils, Hilary, Ambrose, Jerome, Augustine, Leo (q.v.), and a host of other Christian writers, of whose works the modern world knows very little. The growth of monasticism is one of the glories of this age. Monks and nuns consecrated their lives to God's service by prayer and study and labor, thus preserving the ancient civilization from utter destruction by the barbarians, and preparing for the church the means of converting these barbarians and transforming them into the civilized communities of Europe. The intimate union which existed between church and state gave rise to the Holy Roman Empire (q.v.) and to the great body of laws by which their mutual relations were regulated. Frequent attempts were made later to subject the church to the empire. They were frustrated by the popes, and especially by Gregory VII, after whom came the glorious period of vigorous life and eminent learning. Among the orders that were then founded we may mention the Carthusians, Cistercians, Franciscans, Dominicans, and Servites, fruitful in numerous saints and scholars. The church boasts of St. Anselm, Peter Lombard, Albertus Magnus, St. Thomas Aquinas, St. Bonaventure, John Duns Scotus, St. Bernard, and others. It was also the age of the Crusades (q.v.) for the recovery of Palestine. The 14th and 15th centuries are noted for the revival of interest in pagan literature, the sad exile of the popes at Avignon, and frequent movements to effect a much-needed reformation of morals. In this work, many rejected the divine authority of the church and were cast out as heretics; they are generally regarded as forerunners of Martin Luther (q.v.), who succeeded in separating whole sections of Germany from the church, and became the occasion for the Counter Reformation that was effected by men like Francis de Sales, Ignatius of Loyola, and Peter Canisius during the 16th century, and especially by the great work of the Council of Trent (1545–1563). In this same period, millions of pagans were brought into the church by the heroic labors

of her missionaries, notably in South America, India, Ethiopia, and Japan. England, under Henry VIII and Elizabeth, renounced the supremacy of the pope, made a state religion of its own, and by the penal laws almost annihilated the Catholics. France remained Catholic, but, becoming infected with Jansenism and Gallicanism (qq.v.), and later with atheism and socialism, brought about the utter disorganization of Continental society. In the reconstitution of the shattered nations, Napoleon (q.v.) thought to make the papacy his tool, and thus ruin the church; but he failed, and the 19th century witnessed the gradual revival of the church in almost all European countries, and its stupendous growth in the United States and other English-speaking countries. Catholic emancipation in England (1829), the Tractarian movement (see TRACTARIANISM) in the Established Church, that resulted in so many converts to Rome, and the restoration of the Catholic hierarchy (1850), gave Catholics prominence in English life. In France, though the people are loyally Catholic, the government engaged in controversy with the church and in the attempt to control Catholic education. When the French garrison was withdrawn from Rome in 1870, the Papal States and the city of Rome were annexed and added to the Italian kingdom. From 1870 to 1929 the pope never left the Vatican Palace. Shorn of their earthly kingdom, Pope Pius IX and Leo XIII (qq.v.) witnessed the attempt of Bismarck (q.v.), in Germany, to subject the Catholic Church to the state; but they witnessed also the failure of the attempt and the repeal of almost all the iniquitous laws. Persecution served only to unite all Catholics and revealed to them the power of united action. In continental United States the church grew from 244,500 in 1820 to 24,402,124 in 1946. This great increase was due mainly to immigration from Europe and Canada. Irish, Germans, French Canadians, Italians, Poles, and Bohemians have come in large numbers. Meeting with no official opposition, the church has prospered and is regarded by many non-Catholics as a strong power for the preservation of the republic from the new social dangers that threaten the United States as well as the whole civilized world.

The activity of the church in the mission field was almost destroyed by the wholesale confiscations of the French Revolution. As soon as order had been established in Europe, the missions revived, and especially since Gregory XVI, have spread to every land of the world. Dioceses are mapped out and bishops appointed as soon as the circumstances warrant. The reorganization of the Congregation De Propaganda Fide by Pius IX, with separate sections for the Latin and the Oriental churches, has been of great advantage. College, institutes, and special religious congregations have been founded in various cities of Europe for work in the foreign missions. The Society for the Propagation of the Faith is the largest of the societies among the laity for the collection of funds. Missions are also conducted with success in the Oriental churches in communion with the Holy See. These churches hold the same doctrines as the Latin church, but have special rites, discipline, and liturgical language. There are four chief groups: (1) the Greek, subdivided into Greek proper, Melchite, Slav (which is Ruthenian and Bulgarian) and Rumanian; (2) the Syrian, subdivided into Syrian proper, Syro-Chaldean (which also included the Malabar),

and Maronite; (3) the Coptic, which is Egyptian and Abyssinian or Ethiopian; (4) the Armenian. Pope Leo XIII was much interested in these Eastern churches, and had the joy of receiving many converts into communion. For bibliography, see article CATHOLIC CHURCH IN THE UNITED STATES.

(J.J.W.)

Recent Growth and Statistics.—In 1945 the Catholic Church contained within its fold over 393,400,000 members, or approximately one half of the entire Christian population of the globe. It is found in all continents and among all nations but is strongest in southern countries and among the Latin and Celtic races in Italy, Spain, France, Austria, Ireland, and South America. Its history during the 19th century discloses the remarkable fact that while it lost somewhat on its own ground, especially in France and Italy, these losses have been more than offset by the gains throughout the English-speaking world, especially in the United Kingdom, the United States, and Australasia. In England the conversion of Newman, Manning, and others was the beginning of a movement which brought and still brings thousands into the Catholic Church.

Pope Pius IX took official cognizance of the movement by re-establishing the Roman Catholic hierarchy in England in 1850. The growth of the church in Holland led to a similar re-establishment of the hierarchy there in 1853. The Irish emigration to Scotland after 1847 led to a great increase in the number of Catholics in that country, where the Oxford movement also exerted considerable influence; and in 1878, Leo XIII re-established the Catholic hierarchy there. Great and numerous, however, as were the gains in the Old World, they were greatly overshadowed by the vast growth and spread of the church in the New World and in the British dominions overseas.

No one can estimate precisely the number of Roman Catholics there are in the world. Statistics have regularly been given, but those familiar with the different locales and certainly those acquainted with the reliability of statistics have not found existing estimates trustworthy. The number of Catholics reported for some countries, particularly in southern Europe, is generally exaggerated, while in the case of other regions of the world Catholic statisticians believe that the reported data underestimate the actual number of Catholics. This is particularly true for the United States. The best statistics discoverable were prepared by Reverend Albert J. Nevins, a Maryknoll priest, and suggest that in 1945 there were 393,413,888 Catholics in the world. The distribution of these Catholics was as follows: Near East, 691,387; central and north Asia, which includes Mongolia and Manchuria, unknown; India, Burma, and Ceylon, 4,000,000; southeastern Asia, which includes Indochina, Siam, and the Malay States, 1,489,010; China, 3,500,000; Japanese Empire, which includes Korea, Formosa, and the mandated Islands, 283,491; North and Northeast Africa, 1,500,000; East Africa, 1,500,000; West Africa, 1,500,000; Central Africa, 3,000,000; South Africa, 500,000; insular South Africa, 1,000,000; North America, 30,000,000; Central America, 28,500,000; South America, 83,000,000; Australia and New Zealand, 1,850,000; East Indies, 600,000; Pacific Islands, 500,000; Philippine Islands, 10,000,000; Europe, 220,000,000.

The number of Catholics in the chief countries of Europe at the close of World War II was estimated as follows: England, 2,259,104; Czechoslovakia, 10,800,000; Belgium, 7,968,431; Netherlands, 2,293,563; Portugal, 5,612,000; Hungary, 7,131,398; France, 29,000,000; Italy, 43,513,329; Switzerland, 1,677,317; Spain, 25,000,000; Eire, 2,773,920; Germany, 45,000,000. In North America, there were approximately 4,986,552 Catholics in Canada and 19,400,000 in Mexico.

The Official Catholic Directory for 1947 reports that there were 25,268,173 Catholics in the United States, Alaska, and the Hawaiian Islands. These statistics are not completely reliable since they are based upon voluntary parochial reports. The writer, by the use of current birth and death rates, estimates that there were approximately 30,000,000 Catholics in the United States in 1940. He further concludes that more than half of these Catholics resided in what is known as northeastern United States, while the southeast contained but a little more than 1,000,000 Catholics.

The hierarchy consists of four cardinals, 18 archbishops, 98 diocesan bishops, 1 vicar apostolic, and 18 titular bishops, serving as auxiliaries.

The 1947 *Directory* lists a total of 39,980 ordained priests, most of whom belong to the diocesan clergy.

Priests belonging to religious communities include 3,472 Jesuits, 1,425 Benedictines, 2,159 Franciscans, 923 Redemptorists, 950 Dominicans, and thousands more in smaller communities. Professed religious included 6,721 brothers and 139,218 sisters, of whom 61,916 nuns were engaged in works other than teaching. There were, in 1946, a total of 14,523 parishes in the United States, Alaska, and Hawaii, of which 13,583 had resident pastors. In addition, there were 5,124 chapels, 5,084 missions, and 2,316 stations where Mass is offered more or less regularly. The total number of separate educational institutions (11,150) included 59 diocesan seminaries, 273 seminaries, scholasticates, and novitiates, 211 universities and colleges for men and women; 7,493 elementary parish schools, and 543 private elementary schools. There were a total of 22,950 seminarians, 102,655 college students, 477,090 high school students, 2,146,813 elementary school students. The total number of Catholic hospitals was 692 with a bed capacity of 86,919. In the year 1945 there were 87,430 American converts to the Catholic Church.

(J.B.MCD.)

(G.A.K.)

(J.J.W.) JOHN J. WYNNE, S. J.,
Late Editor, The Catholic Encyclopedia.

(J.B.MCD.) JOHN B. McDONNELL,
Editor in Chief, French Edition, Grolier Encyclopedia.

(G.A.K.) GEORGE A. KELLY,
Professor of Labor Ethics, Association of Catholic Trade Unionists, Central Labor School, New York.

4. CATHOLIC CHURCH IN THE UNITED STATES. The Catholic Church came to that part of the New World destined to become the United States with the first explorers. Whether the discovery of America by a European be credited to Christopher Columbus, or to Leif Ericsson five centuries earlier, or to some explorer of an intermediate epoch, it can safely be asserted that the discoverer was a son

of the Church. The English ships venturing to the New World at the close of the 15th century were commanded by Catholics, John and Sebastian Cabot; and in 1502 Mass was said on American shores by an English priest.

The first all Catholic settlement was Spain's at St. Augustine, Fla. (1565). In the 17th century France brought the faith to Louisiana and Indian missionaries journeying down from Canada into what is now Maine, New York, Michigan, and Illinois, represented further developments of early Catholicity here. The Spanish missionaries on the Pacific coast in the 18th century showed how much could be accomplished by such efforts among the Indians when unhampered by the exploitation of the whites. As the result of the Franciscan missions, the Californian Indians, some of the lowest in the country, were in the course of a single generation lifted to a comparatively high level of civilization, living peacefully in their mission towns and occupying themselves with agriculture and domestic manufactures. They developed what amounted almost to genius in the arts and crafts and left monuments of architecture that are standing witnesses, now fortunately being carefully preserved, of the success of their Christian teachers to bring out all that was best in Indian nature.

As a rule, in the 13 original colonies, Catholics were proscribed. Even in Maryland, founded by a Catholic and whose proprietor, Lord Baltimore, had at its foundation proclaimed for the first time in history the practice of religious freedom, proscriptive laws were passed after a time, and Catholics were deprived of most of the rights of citizens. In New York under King James II, Thomas Dongan, a Catholic governor of the colony, granted a charter (1683) far more liberal than that enjoyed by any American colony up to that time, securing for everyone absolute freedom of worship; but after the fall of the Stuarts, Catholics in New York came under rather severe laws once more, so that as late as the middle of the 18th century John Ury, convicted of being a Catholic priest, though he was not, was put to death.

Pennsylvania was the only one of the colonies that tolerated freedom of worship for Catholics before the American Revolution, for even Maryland, founded by Catholics on the principle of religious tolerance, had so turned against that original liberal policy that when there was a question of building a Catholic church in Philadelphia, the project was for a time put off until there was a definite settlement of the dispute then pending, as to whether the land on which Philadelphia was built belonged to Maryland or Pennsylvania.

In spite of this intolerance of the colonists, a great many of the Catholics fought bravely for the colonies in the revolution, so that Washington particularly came to respect them thoroughly. Some, like Gen. Stephen Moylan, became his close friends, while the ardent patriotism of men like Commodore John Barry (q.v.) heartened the Father of his Country at some of the darkest hours of the war. Catholic toleration in Pennsylvania had its manifest good effect, a large proportion of the famous fighting Pennsylvania Line (the Line of Ireland, as Gen. Henry Lee called it) were Catholics. When Guy Fawkes' Day was to be celebrated in Boston with the burning of an effigy of the pope, Washington wrote a letter, still extant, suggesting how un-

suitable was such a celebration when Catholics were taking their parts wholeheartedly with the colonists. One of the important signers of the Declaration of Independence was Charles Carroll, a Catholic, who, when someone remarked that there were so many Carrolls that the British would not know exactly which one it was, designated himself beyond all doubt by adding "of Carrollton." Even John Jay's bigotry, though it alienated Canada, did not lessen the patriotism of Catholics in the colonies. The alliance (1778) with King Louis XVI of France did much to break down intolerance toward Catholics. Members of Congress from all over the country came to be on terms of intimacy with the French and Spanish ministers who had Catholic chaplains with them. Formal religious celebrations of successes in the American Revolution were held in St. Joseph's Church, Philadelphia, Pa., and attended by many prominent in the government of the country. All this helped to break down bigotry. Anne César de La Luzerne, the French minister, who pledged his private fortune to the help of the colonists, was a further important factor in the lessening of prejudice. He won the respect and friendship particularly of New England members of the Continental Congress and became a close personal friend of Governor Jonathan Trumbull of Connecticut, the Brother Jonathan, whose name became the popular symbol of the American people until replaced by Uncle Sam. Benedict Arnold's treason plot proposed, besides the surrender of West Point, a scheme to capture the French minister on one of his visits to Connecticut. Among the excuses alleged by Arnold in extenuation of his treason was that the Quebec Act had granted freedom of worship to Catholics in Canada, and the toleration of Catholicity which he saw was growing in the colonies endangered the Protestant religion. It has sometimes been said that the securing of toleration in the United States was more of an accident than a definite purpose. Anglican and Puritan could not trust each other, so Catholics slipped in under the general religious liberty which had to be voted. As a matter of fact, it seems clear now that the first amendment to the Constitution, guaranteeing religious liberty, was not a little due to Washington's influence and was carried because he wanted to safeguard the rights of the Catholics, whom he had learned to value highly for their heroic efforts for the country during the revolution. In spite of this amendment, however, the laws of many states continued to bar Catholic citizens from their rights. Pennsylvania and Delaware were the only states whose laws did not need expunging in order to secure to Catholics the right to vote and be voted for. In 1784, Rhode Island removed from its constitution the clause disqualifying Roman Catholics from office. This was before the adoption of the federal Constitution, but other states were slow to follow this example. In 1806, New York did so, but Massachusetts waited until 1821; Virginia, until 1830; North Carolina, until 1836. New Jersey did not remove all disqualifications from Roman Catholics until 1844, while in 1876, fully 100 years after the adoption of the 1st Amendment to the federal Constitution, New Hampshire still retained disqualifying laws, only repealed the following year. Shortly after the revolution, the church was organized independently of all foreign influence with John Carroll, (q.v.) a relative of the signer of the Declaration

of Independence, as prefect apostolic, appointed Nov. 26, 1784. Until the revolution, the Catholics in the colonies had been under the jurisdiction of Bishop Richard Challoner, the vicar apostolic of London. His successor refused to exercise any such jurisdiction. It was proposed at first that the church should be under French ecclesiastical jurisdiction, and Benjamin Franklin as American minister to France favored this for a time, but was brought to realize the danger there would be in such foreign influence. Carroll's appointment followed his recognition of this.

In his letter of acceptance, Carroll stated that there were at the time in Maryland 15,800 Catholics; in Pennsylvania 7,000; in Virginia 200; in New York 1,500; a few in New England; and some scattered along the Mississippi, formerly under the jurisdiction of the bishop of Quebec. Altogether there were less than 30,000 Catholics in the whole country. The infant church had some serious troubles, many of them due to what is known as the trustee system. Laymen in control of the funds thought to control also sacerdotal and even episcopal action. The spirit of independence in the new country readily tempted to abuses in this matter, and the first half century of Catholic history has many such disputes, which led to the loss by the church of a number of Catholics, especially of the older families. In 1789, the year of the organization of the government, Carroll was named bishop and consecrated in 1790, so that the state and the Catholic Church run parallel in their formal history. Bishop Carroll at once took up the project of a college, already discussed in 1786, and Georgetown College in the District of Columbia was founded in 1789. Bishop Carroll visited Boston, Mass., and noted with pleasure how the spirit of tolerance was growing: "It is wonderful to tell what great civilities have been done to me in this town where a few years ago the popish priest was thought to be the greatest monster in creation." Previous intolerance can be best understood from the fewness of the Catholic population in New England, for in 1798 the whole number of Catholics was estimated at only 750, this figure including some 500 Catholic Indians in Maine. In 1800, Reverend Francis A. Matignon erected the first building for Catholic services in Boston worthy of the name of a church, "John Adams, President of the United States, and other Protestant gentlemen being generous contributors." New Orleans, where there had been a bishop since 1793, was brought into the United States in 1803 by the Louisiana Purchase; and with it came a large increase in the Catholic population. The religious liberty assured in the country soon brought large numbers of Catholics and led a great many back to the faith which either they or their fathers had abandoned because of religious intolerance and the difficulty of practicing their religion. At Bishop Carroll's suggestion, new bishoprics were created in 1808 in Boston, Philadelphia, and Bardstown, Ky. He recommended that New York be left under the jurisdiction of Boston, but the Irish bishops succeeded in securing the appointment of Father R. Luke Concanen as bishop of New York. Bishop Concanen died before reaching the United States. Michael Egan was chosen bishop of Philadelphia; Jean Louis Lefebvre de Cheverus, bishop of Boston; and Benedict Joseph Flaget, of Bardstown. Baltimore then became an archbishopric. Arch-

bishop Carroll died in December 1815 and was succeeded by Archbishop Leonard Neale, who established the Visitation Convent at Washington, D.C., and restored the Jesuits (Society of Jesus), suppressed by the pope in 1773, but permitted to revive in 1814. Prince Demetrius Augustine Gallitzin of Russia, who had become a priest, did splendid missionary work in western Pennsylvania in the early part of the 19th century, founding in 1799 the town of Loretto, still famous as a Catholic center.

The American church was particularly fortunate in the bishops who occupied these first sees. Archbishop Carroll was a valued and respected friend of the patriots who made the country. Bishop de Cheverus (q.v.), the first bishop of Boston, had been doing heroic missionary work throughout New England for about 15 years before he was made bishop. He was often consulted by the legislature of Massachusetts and accepted many invitations to explain Catholic doctrine, making use for this purpose even of Protestant churches. Speaking of him, William Ellery Channing said: "How can we shut our hearts against this proof of the Catholic religion to form good and great men?" Bishop Flaget (q.v.), another Frenchman, the first bishop of Bardstown, was indefatigable in his missionary labors in the immense territory under his jurisdiction, later divided into 28 dioceses, five of them archdioceses. He won the respect and reverence of all who came in contact with him. The Bardstown bishopric was subsequently transferred to Louisville (1841). Bishop Joseph Rosati, an Italian, the first bishop of St. Louis, Mo., was another one of these marvelous pioneer bishops whose missionary spirit could not be satisfied. In one year his converts numbered 300. Bishop Mathias Loras became the first bishop of Dubuque, Iowa, in 1837 with but one priest to help him, and yet he succeeded in accomplishing immense good and stamping his personality on all the future history of Dubuque. Another very successful French bishop was Joseph Cretin, the first bishop of St. Paul, Minn. Some of the problems he had to meet will be understood from the fact that within a period of six years his flock grew from 1,000 to 60,000. Like Bishop Loras of Dubuque, he was very successful in promoting Catholic immigration and laying deep foundations for the future of his diocese. The bishops were of all nationalities. Frederic Baraga (q.v.), a Slovenian from the west of Austria, was appointed the first bishop of Marquette in 1853 after having labored for 22 years as a missionary among the Indians of Michigan. His writings are still recognized as of high authority on the languages of the American Indians.

The church continued to grow rapidly, particularly in the South and West, and two new bishoprics were created in 1820 in Richmond, Va., and Charleston, S. C. John England (q.v.) of Irish birth, destined to be a great power in the American church, was made bishop of Charleston. His writings are still a storehouse of information on Catholic subjects. The bishoprics of Cincinnati, Ohio, and Saint Louis, Mo., were erected in 1821 and 1826. It was felt that the growth of the church now demanded that the bishops and prominent ecclesiastics of the country should take council of each other for the benefit of Catholicity in America, and the first Provincial Council of Baltimore was held in 1829. The records show that at this time Catholics had in-

creased more than 12 times in numbers in the United States and that there was in 1830 a Catholic population of nearly 400,000.

New bishoprics continued to be founded in the West, and sees were erected at Dubuque in 1837, Chicago, Ill., and Milwaukee, Wis., in 1843, Oregon City, Oreg., 1846, St. Paul, Minn., and Santa Fé, N. Mex., 1850 and San Francisco, Calif., in 1853. Before the acquisition of California, San Francisco had been part of the Mexican diocese of the two Californias erected in 1840. During the decade after 1840, Catholicity increased very rapidly in the United States because of European immigration. The famine in Ireland and political troubles of various kinds in other countries caused a great many immigrants to seek the protection of the United States, and the church had to make provision for a very large increase in its membership. To deal with the new problem thus created, the First Plenary Council of Baltimore assembled in 1852. At this time the Catholic population numbered about 2,000,000; there were 30 episcopal sees including the six archdioceses of Baltimore, New Orleans, New York, Cincinnati, Saint Louis, and Oregon City. In New York and Boston particularly, Catholics increased rapidly in numbers. At the end of the first quarter of the 19th century there were some 15,000 Catholics in the diocese of Boston, about half of whom were in the city, but they were beginning to crowd into all the growing towns of New England: Lowell, Fall River, and Taunton in Massachusetts; Providence and Newport in Rhode Island; and Hartford, Conn. New York grew even faster. At the end of the first decade of the 19th century, Reverend Anthony Kohlmann, S. J., found the parish of Saint Peter's in New York City to contain 14,000 Catholics. He purchased a site for a second church between Broadway and Bowery Road, then on the outskirts, and with the coming of a bishop to New York this became the cathedral. Father Kohlmann who opened a school and was prominent in the intellectual life of the city was once summoned as a witness against prisoners accused of thievery and asked to tell what he had heard from them in confession. This he refused to do in a most solemn way in court, and the presiding justice, DeWitt Clinton, supported him, thus settling for America the question of the status of information obtained in confession as privileged. The second bishop of New York was John Connolly, consecrated in 1814. He was succeeded by John Dubois in 1826. At his arrival he estimated the Catholics in the city at 25,000 and throughout the diocese 150,000. To serve the spiritual needs of this immense number, New York City had only six priests and there were but four in the rest of the state. Albany, Rochester, and Buffalo, though each containing hundreds of Catholics, had no resident priests. Brooklyn had but one small chapel, a mission from New York, visited occasionally by a priest. Newark, Paterson, and New Brunswick, in New Jersey, all of them then in the New York diocese, were only building their small churches. Almost necessarily under such difficult conditions, a great many Catholics lost their faith because of lack of opportunities to practice their religion and bring up their children in it. Some of the Western dioceses were, of course, in even worse straits. Bardstown included besides Kentucky and Tennessee all the country known as the Northwest Territory, embracing what is now the

states of Illinois, Indiana, Michigan, Wisconsin, and Ohio. There were small scattered Catholic communities of French at Kaskaskia, Cahokia, Prairie du Rocher in Illinois; Vincennes, Ind., along the Raisin River and in Detroit and Mackinaw, Mich., at Sandusky, Ohio, and Green Bay, Wis., though there were only three priests to tend to them all. Bishop Flaget within 10 years was able to report that he had in Kentucky alone 19 churches, 10 priests, and 10,000 Catholics.

Pioneer Priests.—Some of the pioneer priests were remarkable men. One of these was Father Gabriel Richard, a Sulpician who did so much for Detroit and the neighborhood at the beginning of the 19th century. The Sulpicians, exiled from Paris by the French Revolution, were of great help to infant Catholicity in America. They founded St. Mary's Seminary in Baltimore (1791) which, after a very trying time at first, proved a wonderful nursery of priests for the American church. In 1831 they founded St. Charles College for clerical students though it was practically not opened until 1848. Father Richard was assigned to the missions in Illinois about 1795, transferred to Detroit in 1798. He opened a young ladies' academy in 1804 and a seminary for young men the same year. The girls were taught spinning and weaving as well as purely intellectual subjects. With Reverend John Monteith, pastor of the Protestant church of Detroit as president and Father Richard as vice president, the "Catholepistemiad or University of Michigan" was founded in 1817. In 1821 when the University of Michigan was incorporated, Father Richard was made a trustee. He published a precursor of the first Catholic paper in the United States, *The Michigan Essay or Impartial Observer* (1809). Before he was able to get the printing press over the mountains he had a public crier who as a "spoken newspaper" gave the news and certain advertisements at the church door on Sundays. In 1823 he was sent to Washington as territorial delegate, the only instance of a priest having a seat in Congress. When cholera visited Detroit in 1832, Father Richard, in his zeal for the sick, fell a victim to the disease. Judge Thomas M. Cooley (q.v.) declared "he would have been a man of mark in almost any community and at any time."

Archbishop Hughes.—One of the greatest of the Catholic prelates of the United States was John Hughes (1797-1864, q.v.) who became coadjutor bishop of New York in 1838 and the first archbishop of that see in 1850. A self-made man who worked his way through Mount St. Mary's College, Emmitsburg, Md., as a gardener, he demonstrated a high quality of intellect in his controversy with a Presbyterian minister, the Reverend John Breckenridge (q.v.), which made the American people realize for the first time how strong was the intellectual position of the Catholic Church. He showed his firm character during the troublous times of trusteeism in Philadelphia and then was made bishop of New York. He at once took up the correction of abuses that had crept into New York life to the detriment of the church. It was due to his efforts that the Public School Society, a private corporation which controlled the funds and managed the common schools of New York, was dissolved, to the lasting benefit of popular education. Bishop Hughes then inaugurated a system of parochial schools which has developed into the magnificent Catholic school system of New York. His con-

troversy with "Kirwan" (Reverend Nicholas Murray) in 1848 probably did more than anything else to make Americans understand how utterly one-sided were the commonly accepted views of the church in the United States. The firm stand that Bishop Hughes took in New York prevented the rioting, destruction and bloodshed, which occurred as a consequence of Native Americanism in 1844 in Philadelphia, and of Know-Nothingism 10 years later, in many parts of the country, from coming to a head in his diocese. See AMERICAN PARTY; KNOW-NOTHING PARTY, THE.

He was well known for his thorough-going devotion to the best interests of his adopted country, and was a personal friend of President Polk and of many men prominent in the political history of the time. During the Civil War he was appealed to by President Lincoln and Secretary of State Seward and was entrusted with a diplomatic mission of an informal character to Europe, particularly to France, in order to neutralize the growing sentiment in favor of European intervention on the side of the South. In spite of failing health which had compelled him to ask for a coadjutor, he accepted this mission at the personal solicitation of President Lincoln, had an interview with the Emperor Napoleon III in December 1861 and then proceeded to Rome, where, during many months, he met prelates from European countries and corrected many false impressions with regard to the American Civil War. The government at Washington felt that his visit to Europe had been of great importance in making the cause of the North better understood, and an official intimation of this was conveyed to the Holy See direct from President Lincoln, suggesting that the archbishop could only be properly rewarded by Rome, but his failing health put that out of the question. President Lincoln wrote a letter commending Archbishop Hughes' patriotism. The last public function that he undertook was a public address delivered shortly before his death to the Catholics of New York with regard to participation in the draft riots (q.v.) which caused so much disturbance to the city and country in July 1863. His address to the crowd had to be made sitting down because of his weakness, and his voice could not be heard far, but his published words made it clear beyond all doubt that the Catholic Church commended to its members their duties as citizens to fight for the conservation of the Union to which they owed so much.

Just before and after the middle of the 19th century the Catholic Church received great additions to its members by the immigration from Ireland, consequent upon the famine and intolerable conditions there, and from Germany because of political disturbances in connection with the revolutions of 1848. Undoubtedly the strongest American influence exerted over these newly arrived Americans was that of the church, and its effect was seen in the large numbers of Catholics of Irish and German descent who fought splendidly and so many of whom shed their blood in defense of the Union during the Civil War. There had been organized intolerance under the name of the Native American Party, which led to the burning of the Ursuline convent at Charlestown, Mass., in 1834, and of two Catholic churches in Philadelphia (1844) as the result of riots in which a number of people were killed. In the 1850's, the Know-Nothings, so called be-

cause of their answer to all questions about the organization, as directed by its rules, was "I know nothing," led to serious disturbances, including the killing of Catholics, the burning of churches and other outrages in some 10 states. The answer to this campaign of bigotry by the patriotism displayed in the Civil War was complete.

About the same time the church began to make large gains by conversion from among the educated people of the country. There was an "Oxford movement" in America as well as in England, and many distinguished converts were made. Among these the best known was Orestes Brownson, renowned as a writer on serious subjects, and Isaac Hecker (of Brook Farm), who gathered round him the group of men who founded the Paulist Congregation, New York, for the conversion of non-Catholics. There were a number of converts from among the Protestant clergy, the most distinguished of them being Reverend Levi Silliman Ives, the Protestant Episcopal bishop of North Carolina, Reverend Thomas Scott Preston of New York, Reverend James Roosevelt Bayley of New Jersey, Reverend George Hobart Doane, the son and brother of Protestant Episcopal bishops of New Jersey and Albany, and somewhat later, Reverend James Kent Stone, president of Kenyon and Hobart colleges, who afterward became Father Fidelis of the Cross of the Passionist Fathers.

The best proof of the recognition by church authorities that the church in the United States should be absolutely American in character and in sympathy with the republican aims of the country is to be found in the fact that a number of these converts were advanced to the highest posts in the hierarchy. James Roosevelt Bayley became bishop of Newark and later archbishop of Baltimore and is said to have been offered the cardinalate which he declined in favor of Archbishop John McCloskey of New York. Other converts who became bishops were William Tyler of Hartford, Edgar P. Wadhams of Ogdensburg, and James Frederick Wood of Philadelphia, who later became archbishop. Father Doane became vicar-general and chancellor of the diocese of Newark, Father Preston became vicar-general of New York, and both were made domestic prelates of the pope. Dr. Levi Silliman Ives was one of the founders and the first president of the Society for the Protection of Destitute Roman Catholic Children in the City of New York and was given as a layman distinguished opportunities for the accomplishment of great good. Many other distinguished converts were made, among them Dr. Jedediah Vincent Huntington (brother of Daniel Huntington, the artist) who wrote a series of Catholic novels; George Parsons Lathrop and Charles Warren Stoddard, poets; Edward Lee Greene, the botanist; Reverend Daniel Hudson of the *Ave Maria*; Molly Elliot Seawell and Frank Spearman, novelists; Rose Hawthorne, the daughter of Nathaniel, who afterward became Mother Alphonsa of the Servants of Relief for Incurable Cancer; Mr. and Mrs. Bellamy Storer; and such distinguished physicians as Drs. William Holme Van Buren, one of the leaders of the profession of New York City, William Edmonds Horner, professor of anatomy at the University of Pennsylvania, Thomas Dwight, Parkman professor of anatomy at Harvard University for 25 years, Thomas Addis Emmet, of international fame in

his specialty of women's diseases, Horatio Storer, former vice president of the American Medical Association and well known for his contributions to American medical literature. The number of conversions grew each year after the middle of the 19th century and increased in the 20th century. It is calculated that about 25,000 converts are received annually into the church. Perhaps the best evidence that the church appeals to thoroughly practical men as well as to those of spiritual and intellectual tendencies is to be found in the fact that altogether of men who reached the rank of brigadier or major general in the Civil War, 46 became converts before their deaths.

The Catholic population of the United States had been growing very rapidly during the decades just before the Civil War. The newly made citizens faced their duty to their adopted country bravely and with few exceptions wholeheartedly. Archbishop Hughes more than any other gave the keynote to patriotism for his fellow countrymen of the North. The archbishop of New York had long considered that slavery was a blot on the United States, and as a young man at college in lyrical mood had invoked Columbia to "chase foul bondage from her Southern plain." In his controversy with Breckenridge he had pointed out the absurdity of paying a compliment to our "memorable Declaration of Independence," coupled with an allusion to slavery. He had taken firm ground against the radical abolitionists, however, pointing out that they had committed the very crime of attempting to overthrow the Constitution and government of the United States which they charged against the Southern Confederacy and urging moderation and conciliation on both sides. Once war was declared, however, there was no halfheartedness about his support of the Union.

Another of the distinguished prelates of the second half of the 19th century was Archbishop Martin John Spalding (1810-1872), a descendant of a family that had been in the United States for many generations. He became bishop of Louisville in 1850 and archbishop of Baltimore in 1864. The growth of the church, and above all the number of conversions had attracted public attention more than ever to Catholicity. The patriotism of Catholics during the Civil War had moderated much of the intolerance felt toward the church, and Americans were now more willing to listen to expositions of Catholic doctrine. Archbishop Spalding responded to a deeply felt want by his lectures in many parts of the country and by the breadth of his scholarly erudition succeeded in placing the church's position properly before the minds of fair-minded Americans. He was the first to suggest the establishment of a Catholic university and to insist that intensive development of the intellectual life would add greatly to the church's position. He came to be held in high esteem by prominent men of all classes and sects in the United States. When the Second Plenary Council of the church in the United States met at Baltimore in 1866 under the primacy of Archbishop Spalding the Catholic population had doubled to nearly 4,000,000, and though the increase was very largely due to Irish and German immigration, the feeling was growing throughout the country that the new citizens were being trained to genuine Americanism under the influence of the church whose hierarchy was deeply patriotic in its policies.

Two distinguished prelates who have been called Fathers of the American Church were the Kenricks—Irish by birth but thoroughly American in their influence on the church. Francis Patrick Kenrick was for a time bishop of Philadelphia (1830), and was transferred to the archbishopric of Baltimore in 1851. He was honored by his fellow citizens of Philadelphia for his courageous zeal during an awful epidemic of cholera and for his tact during the native American riots when 40 persons were killed in the city. His brother, Peter Richard Kenrick, became archbishop of Saint Louis in 1847 and lived to celebrate the golden jubilee of his consecration. His firm stand with regard to the Drake test law led to a decision by the United States Supreme Court which prevented threatened infringement of the constitutional guarantee of religious liberty.

In 1884 when the Third Plenary Council was held, under the primacy of Archbishop (later Cardinal) James Gibbons, the Catholic population had actually doubled once more to 8,000,000. The new primate, Cardinal Gibbons, was destined to occupy a place of particular affection in the hearts of the American people and to be looked upon as a typical representative of all that was conservative in American life. His published opinions came to be looked upon as almost national messages, always read with attention and considered with reverence. The church continued to grow rapidly under the favoring influence of religious liberty and doubled once more in numbers by the beginning of the new century.

Religious education came very early to be recognized as an extremely important factor for the church's growth in the United States and for the conservation of the spirit of Christianity. The Catholic hierarchy was firmly persuaded, to use Herbert Spencer's words, that "it works grave mischief whenever intellectualization precedes moralization." The first Catholic college, that of Georgetown, was established in 1789, the very year of the organization of the Union. Other colleges followed. Catholic higher education for women began with the establishment of the Visitation Academy, Georgetown, D. C., in 1799. Mother Elizabeth Seton's organization of the Sisters of Charity and the foundation of Saint Joseph's Academy, Emmitsburg, Md., followed in 1809. The first institution for giving anything more than education in the ordinary branches to girls in New England was the Ursuline Academy in Charlestown, Mass., opened in 1834 and, though mainly attended by the children of Protestant parents, was burned down that year by a mob from Boston at the risk of the lives of some of the pupils.

For statistics on Catholic education in the United States, see *CATHOLIC CHURCH, ROMAN—Recent Growth and Statistics*; *CATHOLIC EDUCATION IN THE UNITED STATES*.

After education, the church considers its most important work the organization of charity. The oldest hospital founded by private beneficence still in existence in what is now the United States is the Charity (Sisters) Hospital at New Orleans, La., dating from 1720. In 1829 four Sisters of Charity went to St. Louis from Emmitsburg to open the Mullanphy Hospital, which had been endowed by John Mullanphy. In 1832 when an outbreak of cholera in Blockley Hospital, Philadelphia, utterly disorganized that hospital, six sisters, by request of Bishop Kenrick, started

from Emmitsburg within two hours after the summons and took charge, restoring order there and giving the institution "its one short interregnum of peace in the distressing reign of violence, neglect and cruelty." (Nutting, M. A., and Dock, L. L., *History of Nursing*). In 1847, Mercy Hospital, Pittsburgh, Pa., was founded, to be followed by a chain of hospitals under the care of the Sisters of Mercy throughout the country. In 1849, St. Vincent's Hospital, New York, was established by the Sisters of Charity. Carney Hospital, Boston, was founded in 1868. Sisters' hospitals have come to occupy a prominent place in American life, there being some 690 Catholic hospitals in the country. The sisters also have charge of the orphans, of the foundlings, of a number of institutions for the old, as well as for the insane and the tuberculous. Mother Cabrini (St. Frances Xavier) founded a series of hospitals, beginning with Columbus Hospital, New York, 1892, orphan asylums and schools in the country for the Italians, which have helped very much in solving the social problems connected with this large group of new citizens.

For details of Catholic missionary activity in the United States, see *MISSIONS, ROMAN CATHOLIC*.

Toward the end of the 19th and the beginning of the 20th century the church in the United States received large additions to its number through the immigrants from the Slav countries. Slav Catholics in the United States numbered approximately 5,000,000 (1948).

This large foreign immigration to America has introduced a series of new problems and elements into the political life. They are not very different from those which occurred as a consequence of German and Irish immigration at the middle of the 19th century. The church was an important factor in the transformation of these European stocks into American citizens of sterling patriotism. Her ministrations under the direction of a hierarchy that has shown itself thoroughly American and free from any political bias that might hamper free development, is accomplishing a similar transformation for the Slavs and the Italians. President McKinley declared the influence of the Catholic Church in this matter as extremely precious for the future welfare of the country. The decided stand taken by the church against all the forces of anarchy has meant much for preserving the balance of conservatism among newly arrived peoples, so liable in the first flush of their enjoyment of liberty to go too far in what they expect of it.

Roman Catholic societies organized to foster social aims, provide fraternal insurance, and organize public opinion against abuses and immoralities of various kinds play an important part in American Catholic life. They include the Holy Name Society, organized to discourage blasphemy, but doing social work of many kinds, which counts a membership of a million. The Legion of Decency, established in 1934, to raise the moral and intellectual level of motion pictures; the Society of St. Vincent de Paul (q.v.), and the temperance societies which flourished in the last decades of the 19th and first two decades of the 20th centuries. The National Councils of Catholic Men and Women, with headquarters in Washington, D. C., integrate the various Roman Catholic organizations in the United States.

For Catholic population in the United States see section 3. of this article.

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JAMES J. WALSH,

*Author of "Catholic Churchmen in Science";
"The Popes in Science."*

Revised by: GEORGE A. KELLY,
*Professor of Labor Ethics, Association of Cath-
olic Trade Unionists Central Labor School,
New York*

5. CATHOLIC EDUCATION IN THE UNITED STATES. The first schools within the present limits of the United States were those founded by the Franciscans in Florida and New Mexico. St. Augustine, Fla., had a classical school as early as 1606, and there were a number of schools in existence for the natives of New Mexico in the year 1629. Schools for the natives were likewise established in Texas and California, with the foundation of the missions in those regions. Ursuline nuns from France established a parish school and academy in New Orleans, La., in 1727 a few years after the foundation of the city. French schools, for both white and native children, were also opened at St. Louis, Mo., Detroit, Mich., and other settlements to the north. In general, it may be said that Catholic school work usually began in a place, whether it was a white or an Indian settlement, as soon as there was a sufficient Catholic population and organization to furnish support for the school. In the East, the Jesuits in Maryland had opened schools by 1650, and a college or "school for humanities," was established there in 1677. Later on, a boarding school was opened at Bohemia, on the Eastern Shore of Maryland. Among the famous pupils of this institution were John Carroll and Leonard Neale, who subsequently became archbishops of Baltimore, and Charles Carroll of Carrollton, one of the signers of the Declaration of Independence. Georgetown College was founded in the year 1789. A more favorable opportunity for educational work was offered to the Jesuits in Pennsylvania, owing to the tolerant attitude of the Quakers, and, with the organization of the first Catholic parish in Philadelphia in 1730, the

foundation of schools as a regular and permanent feature of parish work may be said to have begun. Philadelphia had a larger Catholic population than any other town in the country, and the system of schools that was gradually established there and throughout Pennsylvania, as new parishes were organized, became a model to Catholics elsewhere. A new impulse was given to Catholic education by the American Revolution. Catholic immigrants came in increasing numbers, and learned priests, exiled by the French Revolution, arrived opportunely to take up the work of organizing parishes, schools, and colleges. In 1791 the Sulpicians founded St. Mary's Seminary at Baltimore. Foremost in Catholic educational work west of the Alleghenies were Fathers Stephen T. Badin and Charles Nerinckx in Kentucky, Father Gabriel Richard in Detroit and other places in Michigan, and Father Edward Fenwick, a Dominican, first bishop of Cincinnati, in Ohio. What was accomplished in these three states had a very important influence in the development of Catholic education throughout the whole Middle West later on. During the period 1800-1840 the progress of Catholic education, while slow, was steady and solid, and corresponded with the growth of the church. Catholic textbooks began to appear, and, more important still, religious sisterhoods were organized to carry on the work of teaching in the schools. The first teaching sisters in the English-speaking states were the Poor Clares, who opened a school at Georgetown, D. C. in 1801. This order soon discontinued educational work; but in 1812 an American branch of the Visitation Order was founded at the same place by Bishop Neale. Mother Elizabeth A. Seton (q.v.), under the direction of Father Louis Guillaume Du Bourg, organized the Sisters of Charity at Emmitsburg, Md., in 1809; this community grew rapidly and furnished teachers to Catholic schools in all parts of the country. Shortly afterwards, three teaching communities were founded in Kentucky—the Sisters of Loretto, the Sisters of Charity of Nazareth, and the Sisters of St. Dominic. These teaching communities rendered it possible for Catholics to carry on their schools and academies without aid from the state and to extend the educational system to new centers of Catholic life as fast as they became organized. Among the religious orders of men, the work of the Lazarists and Jesuits during this period deserves particular mention, the latter having laid the foundations of St. Louis University, Mo., in 1828. Another great forward movement in Catholic education originated in the tide of immigration that set in about the year 1840. Hundreds of thousands of Catholic Irish and Germans made their way to the Middle Western states and beyond. Zealous priests and bishops of the newly created dioceses labored to erect everywhere not only churches but schools. After the failure of Bishop John Hughes of New York to secure for the Catholic schools of that city a share of the public educational funds, although his efforts were warmly seconded at Albany by Governor William H. Seward, it was more keenly realized by Catholics that it had become a matter of religious necessity for them to erect and maintain their own schools and that, as Bishop Hughes declared, "In this age and country the school is more necessary than the church." At the instance of the bishops, many new teaching communities came from Europe, and their member-

ship was rapidly augmented under the favorable conditions offered for religious and educational work. The result was that, while in the year 1840 there were only about 200 parish schools in the country, this number was multiplied several times over during the ensuing decade. Academics for girls were established by the Ladies of the Sacred Heart and other sisterhoods, while the Christian Brothers took the lead in the field of secondary education for boys. Colleges and seminaries, also sprang up. The Jesuits carried their work of higher education into every section of the country by founding colleges and preparatory schools. A later phase of the immigration movement resulted in the establishment of schools for French-Canadians, Poles, Italians, Bohemians, and other nationalities. Of these, the Polish schools are the most numerous.

School Organization.—In accordance with the church's organization, Catholic elementary education is framed along diocesan lines. Each diocese has its school system, with the bishop at its head. Bishops, however, are bound by the legislation of the Third Plenary Council of Baltimore, which prescribed a definite form of school organization for all the dioceses. General legislation has thus operated to give a certain measure of unity to parish-school work the country over, while local needs and interests are left to be provided for by the diocesan authorities. Diocesan control over the schools is usually exercised through the diocesan school board, presided over by the bishop. The members are selected from the clergy of the diocese; in some places the laity are included. In the prevailing type of school organization the school board includes, as its executive officer, a diocesan superintendent of schools. The priest who is selected for this office is specially trained for his work; he devotes his time to the inspection of schools and to the study of the problems involved in their improvement, and his recommendations are embodied in an annual report submitted to the school board. As assistants to the superintendent, there are in many dioceses community inspectors of schools. As a rule, there are many teaching orders engaged in any given diocese, and when each community appoints one of its members to inspect and study the work that is being done in its own schools in the diocese, the result is to give the superintendent a corps of zealous and efficient assistants through whose co-operation his recommendations may the more easily be given practical effect. In the case of the individual parish school, the pastor is, of course, by right its head; but, generally speaking, beyond supervising the religious instruction and financial matters, he leaves the direction and control of the school to the superior of the sisters or brothers in charge. The actual principal of the school is therefore the immediate religious superior. The teachers usually live in or near the school building, which is in close proximity to the parish church. About nine tenths of the teachers in the parish schools are religious. Male teachers are less than one fifteenth of the total number. Nearly 300 distinct communities are engaged in the work, including single independent houses as well as congregations. Of these, 11 are teaching brotherhoods. The curriculum of the parish school does not, as a rule, show any substantial difference from the curriculum of the neighboring public schools, except in the matter of religious instruction.

The training course for religious teachers embraces the postulate, the novitiate,* and the normal school. In the postulate are included the elements of a good common school education and some high school work; during the novitiate—generally of one year—study is continued, but the chief aim is the religious formation of the candidate. In the normal school, proximate preparation is made for the work of teaching, through suitable pedagogical studies, while more advanced academic courses, sometimes leading to the college degree, are also taken up. Such is the training course that obtains in the more progressive communities; in many instances, however, this ideal program is not strictly adhered to in practice, owing to the demand for teachers. But the tendency is steadily toward higher standards. Much has been accomplished in this direction through the work of summer institutes and summer schools conducted especially for teachers by colleges and universities. Worthy of special mention in this connection is the Sisters' College, at the Catholic University of America, Washington, D. C. Many sisterhoods are now sending picked young teachers to this institution for college and university courses as well as normal school training. Money for the support of the schools is obtained from three sources: tuition fees, the parish treasury, and endowments. The amount derived from the last-mentioned source is practically a negligible quantity, except in the case of a few favored schools. The tuition fee was long the prevailing source of school revenue, but it has been replaced to a great extent by the simpler and more direct means of support, the parish treasury, especially in the cities and larger towns. Schools thus supported are called free schools. In many places, in accordance with the practice in public schools, textbooks are also supplied free. The salaries of sisters engaged in parish-school work probably average \$50 per month, or \$500 per year. Brothers who teach in the parish schools generally receive from \$600 to \$750 a year. Teachers in Catholic schools thus receive less than one half the salary of public-school teachers of the same class, and in many parts of the country they receive barely one third as much. Yet out of their slender salaries the religious teachers have not only to maintain themselves, but also to save something as a contribution to the support of the mother house and its various establishments, such as the training schools, the infirmary, and the like. Only by the practice of the strictest economy, joined to the most devoted personal self-sacrifice, are the members of religious communities enabled to accomplish these objects successfully. As might be inferred from the above data, elementary education in Catholic schools costs less than one half as much as elementary education in public schools. The actual cost per capita of Catholic elementary schooling throughout the country averages only about \$26 a year.

Alongside the parish-school system there have been developed secondary schools or high schools. These belong to several distinct types: the college preparatory school; the parish high school—an adjunct of a particular parish school; the diocesan high school, under the control of the bishop; and the independent high school, conducted by a religious order and more or less independent of diocesan control. There is a strong movement toward the more general establishment of diocesan high schools, since these form

an integral part of the diocesan school system and thus contribute more effectively to the unification of Catholic educational work. Notable among institutions of this class, for their typical character and influence, are the Boys' Central High School and the Girls' High School in Philadelphia.

An important agency in the changes that have been brought about in Catholic education in the direction of more perfect organization has been the National Catholic Educational Association, which was organized in 1904, and includes three main departments—elementary schools, colleges, secondary schools, and seminaries.

School Enrollment.—In the year 1945 there were 8,097 Catholic elementary schools (parochial and private) in the United States with an enrollment of 2,086,794 pupils, and with about 60,000 teachers. The number of pupils in 2,128 high schools and academies was 420,707, with a teaching staff of about 25,000. Investigation has shown that the total actual enrollment in Catholic schools is not quite one half that which the Catholic population of the country should normally supply. This means that about the same number of Catholic children go to the public schools as go to the parish schools. There are over 200 Catholic industrial schools; many girls' schools furnish instruction, in the upper grades, in practical household subjects.

Included in the total school enrollment are 262 schools for colored children, with an enrollment of 56,185. A number of teaching communities devote themselves especially to this work, several of these being composed of colored sisters. These schools, as a rule, derive their support from general church collections and gifts from generous individuals. There were also 67 schools for the education of Indians, with 7,628 pupils. There are 16 Catholic schools for the deaf, with an enrollment of approximately 1,700. According to official figures there were in the United States in 1945 a total of 10,697 Catholic schools of all grades. These institutions employed a total of 100,758 teachers, and were attended by a total of 2,688,271 students.

Colleges.—From an enrollment of approximately 16,000 students in 1916, the attendance at Catholic colleges and universities increased to 148,515 in 1945. The movement toward the development of universities, which has been characteristic of the progress of American higher education, has affected many of the larger Catholic colleges. Eighty-two institutions now have at least one professional department, while quite a number have several professional departments, in addition to postgraduate courses of study. Pre-eminent among Catholic institutions of higher education in the United States is the Catholic University of America, Washington, D. C., which is under the direction of the bishops, and which has a large postgraduate attendance and many affiliated institutions. One hundred and eighty-three institutions are conducted by the religious orders. Catholic colleges and universities are, as a rule, self-supporting; only a few are even partially endowed, with the exception of the Catholic University of America. Religious professors receive no salary, the services they render being entirely gratuitous; hence the college, being free to a great extent from the heavy financial burden of professors' salaries, is able to devote the revenue derived from student fees to its general expenses. Lay professors are not ex-

cluded, but their number is relatively small, except in a few instances. There is, however, a tendency to increase the number of lay professors; many of the colleges are endeavoring to raise endowment funds, largely with this end in view, and considerable success has attended these efforts. The gratuitously rendered services of the religious professors at the Catholic college or university are therefore equivalent to an endowment fund and in many instances its amount will compare favorably with the endowment of non-Catholic institutions.

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Seminaries.—The name "seminary" is applied by the Catholic Church specifically to institutions in which candidates for the diocesan (secular) priesthood receive their spiritual and intellectual training. Seminaries came into being at the command of the Council of Trent (1545-1563). The term is also commonly used for similar institutions conducted by religious congregations for the education of their own members.

There are two kinds of seminaries: major and minor, or preparatory. Minor seminaries give a four year high school and two-year college course in general academic subjects. In the major seminary, which is usually a separate establishment, candidates are trained for six more years in a curriculum centering in philosophy and theology. During the years of theology, the seminarian receives minor orders, and the major orders of subdiaconate, diaconate, and priesthood. His studies include dogmatic, moral, and pastoral theology, Scripture, apologetics, church history, canon law, liturgy, social sciences, homiletics, and sacred chant.

Seminaries are directed according to norms prescribed by the Code of Canon Law. The bishop of the diocese provides for and supervises his seminary in all things pertaining to government, discipline, temporal administration, and studies. A rector is the immediate superior, and the majority of professors are priests especially trained for the purpose. Ultimately, all seminaries fall under the supervision of the Congregation of Seminaries and Universities at Rome.

The first Catholic seminary in the United States was St. Mary's Seminary in Baltimore, Md., opened on Oct. 13, 1791. It was founded at the request of Bishop John Carroll of Baltimore, who obtained four members of the Society of St. Sulpice as a faculty. This society of secular priests had been founded in France in 1642 for the express purpose of training priests. In 1805 the Maryland legislature granted a university charter to St. Mary's. Its department of philosophy is located at the original site, while the theological students are housed in buildings opened at Roland Park, Baltimore, Sept. 30, 1929. Its minor seminary is St. Charles College, Catonsville, Md., which received its charter in 1830. There are approximately 900 seminarians in these institutions, taught by 58 priests. For many years, St. Mary's was the only institution of its kind in the United States, and during this period it supplied the church with the majority of the priests trained there.

The Sulpician Fathers also conduct the Theological College of the Catholic University of America in Washington, D. C. They have charge of St. Patrick's, the major seminary of the archdiocese of San Francisco in Menlo Park, Calif. Mount St. Mary's Seminary, Emmitsburg,

Md., was founded in 1808 by the Reverend John Dubois of the Sulpicians; it is now conducted by diocesan priests.

The major seminary of the archdiocese of New York is St. Joseph's Seminary and College, dating from 1864. It was established in Yonkers, N. Y., in 1897, replacing the old provincial seminary at Troy, N. Y. St. John's Boston Ecclesiastical Seminary for the Boston archdiocese was founded by Archbishop John J. Williams in 1884. It is located at Brighton, Mass., and is directed by diocesan priests.

The Theological Seminary of St. Charles Borromeo, Overbrook, Pa., is the major seminary of the archdiocese of Philadelphia. It traces its origin to 1835, when Bishop Francis P. Kenrick placed five students under the care of his brother, Reverend Peter Kenrick, in a small house in Philadelphia.

As a general rule, the largest and most influential seminaries of the United States are found in the various archdioceses of the country. Diocesan priests have been placed in charge of St. Francis Seminary at Milwaukee, Wis.; the St. Paul Seminary of St. Paul, Minn.; Mount St. Mary Seminary of the West at Norwood, Ohio, for the archdiocese of Cincinnati; and Immaculate Conception Major Philosophical Theological Seminary, Darlington, N. J., for the archdiocese of Newark. The faculty of St. Mary of the Lake Seminary, Mundelein, Ill., of the archdiocese of Chicago, comprises both diocesan priests and members of the Society of Jesus.

Priests of the Congregation of the Mission (better known as Vincentian Fathers) have been very active in training candidates for different archdioceses. They conduct The St. Louis Roman Catholic Theological Seminary (Kenrick Seminary) in St. Louis, Mo.; St. Thomas Theological Seminary in Denver, Colo.; St. John's Seminary at San Antonio, Texas; and St. John's Seminary at Camarillo, Calif., for the archdiocese of Los Angeles. At the Seminary of Our Lady of Angels, part of Niagara University (founded 1856), Niagara Falls, N. Y., priests are trained for the diocese of Buffalo. For many years priests for the diocese of Brooklyn received their training at St. John's University, Brooklyn, N. Y.

Notre Dame Seminary in New Orleans, La., is in charge of the Marist Fathers. Monks of the Order of St. Benedict train many diocesan priests in abbeys located in different parts of the United States. Important among them are St. Vincent's Archabbey at Latrobe, Pa., St. Meinrad's Abbey, St. Meinrad, Ind., Conception Abbey, Conception, Mo., and St. John's Abbey, Collegeville, Minn. Similar work is done by the Franciscan Fathers at St. Bonaventure's College, St. Bonaventure, N. Y., and St. Francis Seminary, Loretto, Pa.

The only seminary in the United States directly subject to the Congregation of Seminaries and Universities in Rome is The Pontifical College Josephinum, founded by Msgr. Joseph Jessing at Columbus, Ohio, in 1888. It is now located in Worthington, Ohio; its priests may be sent to any diocese in the United States after their ordination.

In 1920, the Society of the Divine Word established St. Augustine's Mission House, a college and seminary at Bay St. Louis, Miss., to train Negro candidates for the priesthood. In 1937 the bishops of the United States founded

Montezuma Seminary at Las Vegas, N. Mex., to educate Mexican students for the dioceses of their home country. This seminary is directed by priests of the Society of Jesus. In Europe two institutions are maintained by the American bishops for the training of American students, the North American College in Rome and another at Louvain, Belgium.

In 1947, there were 60 diocesan seminaries, major and minor, in the United States, with about 7,600 students, in addition to 3,500 diocesan candidates in religious seminaries. Seminaries of all kinds (novitiates, scholasticates) maintained by religious orders for their own students totaled 278, with an enrollment of 12,720 students. The total number of seminarians in the United States was about 23,700 in 1947.

(J.P.K.)

Summer Schools.—The first Catholic summer school, called the Catholic Summer School of America, was organized in New York State in 1892. After several years of trial it was established permanently at Plattsburg, N. Y., and was continued there until 1942, when it was suspended because of war conditions. In the meantime, other schools of a more formal type began to develop. During the summer of 1945 there were 135 of these schools, located in every part of the United States. Of these, 129 were special summer sessions, normally six weeks in length, while six were part of a trimester program. The main purpose of the summer session is to afford Catholic teachers an opportunity to obtain more professional training, to earn credits for higher degrees, or simply to maintain alertness in their respective fields. Usually courses are offered in all departments of the school, on both graduate and undergraduate levels. A maximum of six hours of credit can ordinarily be earned in a six weeks' session. Upon the successful completion of the required courses, a bachelor's or a master's degree can be obtained. To expedite the attainment of these degrees, many schools offer to their students a chance to do supplementary work during the regular school year by late afternoon or Saturday classes. Other types of Catholic summer schools, known variously as work shops, institutes, or conferences are being developed. Sponsored by the larger schools, they usually have for their purpose an intensive study of some particular phase or problem of education. These vary in length from a few days to six weeks.

(M.J.MCK.)

STATISTICAL SUMMARY (1945)

(Authority: National Catholic Welfare Conference, Department of Education)

Catholic population of the United States	25,268,173
Seminaries	238
Universities and Colleges	196
Teachers' colleges and normal schools	38
Secondary schools	2,128
Elementary schools	8,097
Enrollment	21,970
	148,515
	10,285
	420,707
	2,086,794

(J.E.C.)

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(J.A.B.) JAMES A. BURNS, C.S.C.,
Late President, Notre Dame University.

(J.E.C.) JAMES E. CUMMINGS,
*Assistant Director, Department of Education,
National Catholic Welfare Conference.*

(J.P.K.) JOHN P. KLEINZ,
*Department of Philosophy, Pontifical College
Josephinum.*

(M.J.MCK.) MICHAEL J. McKEOUGH,
The Catholic University of America.

6. CATHOLIC PRESS OF THE UNITED STATES. Like many other American institutions, the American Catholic press had heroic beginnings in pioneer days, almost heart-breaking struggles to survive as it grew up, and finally emerged into a hard-bitten permanence that is deeply rooted, strong, and (in the mid-20th century) still in vigorous development.

This press began with the very early days of the republic: one precursor of the American Catholic newspaper was founded before George Washington first took office as president; a priest established a paper only nine years after the national capital was set up; the first Catholic magazine was launched while Charles Carroll, Catholic signer of the Declaration of Independence, was still alive. Many of the initial efforts were short-lived. Nevertheless, in the first 50 years, valiant work was done and a few of the journals then established were still published in 1948. In the next 40 years, there were numerous foundings and a high mortality among Catholic press units, but following the Civil War, some hardy publications began to survive. With the next 40 years, a flowering began as the reward of perseverance; once rooted, an increasing number endured. After 1920, a remarkable growth in numbers and variety was experienced; circulations multiplied, giving material soundness and a real durability of life.

In 1947 the Catholic press of the United States could boast 399 publications—aside from thousands of purely local bulletins of parishes, societies, and individual schools and institutions. There were 144 newspapers with a circulation above 4,000,000, and 255 magazines with 10,000,000, giving a circulation total of roundly 14,000,000.

Formative Years (1789–1839).—Struggle, determined, persistent and spirited, must be the characterization of the Catholic press in this period of pioneering. At times the effort was brilliant; at times, grim, but always willing and alert. It was an era of vicious attacks on Catholicism in the United States and in Europe. Extravagant charges, based on what are now generally recognized as prejudice and ignorance, were rife. It was to meet these that Catholic journals were first established, and it was because of these that they were often sharply controversial, sometimes polemic. They did not retort in kind with attacks on Protestantism. Rather, they conducted with vigor and insistence what Paul J. Foik, C.S.C., historian of this era, describes as “nothing more nor less than a gigantic struggle for the civil and religious liberty of the people.” With the conviction that misconceptions of Catholic teachings were at the root of the strife, the Catholic journals devoted themselves to clearing away these erroneous ideas. The ablest Catholic

paper in the period prominently displayed these words from the 1st Amendment to the Constitution: “Congress shall make no law respecting an establishment of religion, or prohibiting the free exercise thereof.”

The first strictly religious Catholic publication in the United States was the *United States Catholic Miscellany*, founded June 5, 1822, by the brilliant John England, bishop of Charleston. It was so sanely and, at times, so brilliantly conducted that it endured until the Civil War. The first Catholic magazine was the scholarly *Metropolitan*, established at Baltimore, Md., in 1830, which persisted only one year. Before and after these “firsts,” no fewer than 39 other journals flashed into (and most of them out of) existence in this initial half century of the nation, if we include precursors. This despite the paucity of Catholics in the early United States, and the acute meagerness of presses. Catholic publications appeared in 14 cities, not only in the two great national centers of population, New York and Philadelphia, but also in Baltimore, Bardstow, Ky., Boston, Charleston, Cincinnati, Detroit, Hartford, Louisville, Milwaukee, St. Albans, Vt., St. Louis and Washington, D. C. Of the 41 publications founded, 33 were almost ephemeral, but two of the newspapers still existed in 1948. No magazine and but one annual survives. One other paper lasted into the 20th century; two were stilled by the Civil War.

While Catholic publications of actual religious character were not established until 1822, there were earlier journals that were Catholic in tone or sympathy, and under Catholic guidance, even though not definitely Catholic in content. The first of these was the *Courier de Boston*, begun in April 1789, edited by a Harvard University instructor, Paul Joseph Guérard de Nancrède, and continuing half a year. In 1809, there appeared momentarily in Detroit the *Michigan Essay or Impartial Observer*, fostered by the enterprising missionary Father Gabriel Richard. The pioneer Boston effort was in the French language; the first issue of the *Michigan Essay* contained a column and a half in French, and there is record of two more semi-Catholic French papers in this period. There also appeared, in 1824 in Philadelphia and later in New York, a Spanish magazine, *El Habanero*, not professedly Catholic, but containing articles on ecclesiastical subjects and conducted by the remarkable Cuban priest and patriot the Very Rev. Dr. Felix Varela. It persisted only two years, but its tireless editor launched two other short-lived publications and edited or was coeditor of four others.

By far the most interesting national newspapers were the long series of Irish journals. These began in 1810 and had Catholicity and Ireland for their chief topics. They were essentially political and Irish rather than religious publications. Not only as a matter of race, but also of religion, the Irishmen who came to America in those times were compelled to defend themselves. Their zeal for their church was not exceeded by zeal for their native land or love of liberty. Thus there started, with the *Shamrock or Hibernian Chronicle* of New York, a succession of a dozen or more publications with Catholic and Irish defense as their objectives. These Irish journals were hard-hitting and a valuable resistance to the bitter anti-Catholic charges of the times. In general, they existed only two or three years, with the notable exception of the *Truth*

Teller of New York, begun in 1825 and closing an eventful career in 1855. The *Shamrock* struggled for 14 years, but with a suspension nearly every other year.

With the appearance of actual Catholic journals, the *Miscellany* in its prospectus gave these assurances: "The principles of the publication will be candor, moderation, fidelity, charity and diligence." Bishop England assembled agents for the paper in 31 cities of the young country. It was because of careful planning that the *Miscellany* continued until the 1860's. Second of the journals with episcopal approbation was the *Catholic Press*, which was begun at Hartford in 1829 by Bishop Benedict J. Fenwick of Boston and which lasted four years. The oldest American Catholic newspaper began as the *Catholic Telegraph* of Cincinnati, launched in 1831 by Bishop Edward D. Fenwick, apostle of Ohio. It survived the Civil War by following a wise and loyal course; was once edited by Sylvester H. Rosecrans, convert, brother of the Civil War general, and later bishop of Columbus; was at one time rescued by leading Catholic laymen, headed by Dr. Thomas P. Hart, later its editor and one of the best-loved figures in the field; and continues vigorously (1948) as the *Catholic Telegraph-Register*. The Boston *Pilot*, the other surviving formative period journal, was founded in 1836; was at times edited by the meteoric Thomas D'Arcy McGee, the celebrated John Boyle O'Reilly, and James Jeffrey Roche; was conducted skillfully throughout the Civil War by Patrick Donahoe; was wiped out three times in six months by fire in the 1870's, but occupies a prominent place in the 20th century. The *Pilot's* predecessor was *The Jesuit or Catholic Sentinel*, begun in 1829 by Bishop Benedict J. Fenwick in the face of puritanical survivals of prejudice, battling through the great convulsion of the burning of the Charlestown Ursuline convent in 1834, and surviving for six years. *Der Wahrheitsfreund* (*Friend of Truth*), outstanding German Catholic newspaper established in Cincinnati in 1837 by John Martin Henni, afterward archbishop of Milwaukee, continued until 1910, and was the great defender of the faith among newly arrived German immigrants. *The Catholic Herald*, launched in Philadelphia in 1833, with John Hughes, later archbishop of New York, as its first editor, continued for 33 years, and fought through the fire, bloodshed, and death of the anti-Catholic Nativist riots in the City of Brotherly Love in 1844. *The Catholic Advocate*, founded at Bardstown in 1836 but later moved to Louisville, continued until 1850. *The Official Catholic Directory*, later published by P. J. Kenedy & Sons of New York was established in 1822; it has been published annually since 1833.

Magazines in this period were notably few and short-lived. They numbered only five. Two juvenile publications were essayed, but failed. Seven bishops (or future bishops) were founders, sponsors or editors of journals of this period. Publications so begun had by far the greatest enduring qualities: one was hale in 1948; one persisted into the 20th century; two lasted until the Civil War. There is a record of 10 other priests who were founders or original editors.

Second Period (1840-1884).—For the nation, this was a confused era of growth and strife. For the Catholic Church, it was a continuance

of difficult but steady increase and expansion. For the Catholic press, it began with intensification of controversy, but this gradually waned and a general broadening began. Up to 1840 attacks on the church had been mostly verbal. Now there was resort to action, with appalling burnings and bloody riots. But these very excesses seemed to have a sobering effect on the anti-Catholic spirit. Non-Catholics gradually began to form more moderate judgments. Undoubtedly the arduous and persistent journalistic labors in the days before had done much to bring this about. With roots already planted, the Catholic press started to penetrate new territory and to expand as to content. Non-English speaking immigrants necessitated foreign language journals, and these were founded in considerable numbers. From 1840 to the beginning of the Civil War, foundations of Catholic publications more than doubled their yearly rate. Two newspapers survived in 1948 from those two decades. Virtually no foundations were made during the Civil War, but in the 19 years from 1865 to 1884, there was a host of them. We have definite record of 124, and of these, 31 were still in existence in 1948. We know of 171 Catholic publications started in the entire second period, of which 33 continue—20 newspapers, 13 magazines. The rate of survival had quadrupled.

Geographical expansion was vigorous. The Catholic press was extended to San Francisco and Portland on the west coast, and to New Orleans, Augusta, Memphis and Richmond in the South, establishing itself in most of the cities growing up around the Great Lakes, and penetrating energetically into the Midwest. A count of cities adds more than 50 to the 14 represented in the formative period. The first English language Catholic daily appeared in this period, although only briefly, when Peter McCorry launched the *Daily Telegraph* in New York in 1875. Catholic dailies twice were attempted in the German language field, but failed. Magazine attempts, sterile in the first period, began to bear fruit. Systems or chains of papers appeared. There was a notable multiplication of German language publications: in the 14 years between 1870 and 1884, no fewer than 20 are known to have started, and six survived in 1948. Several Polish publications were established, one of which continues (1948). One Spanish and one Bohemian paper likewise are survivors. French, Portuguese, and Dutch Catholic papers also were founded.

The colorful and important *Freeman's Journal* of New York, established in 1840, persisted until 1918, at times with heroism. Among its celebrated editors were James Roosevelt Bayley, afterward archbishop of Baltimore; the skillful, brave, but sometimes eccentric, convert, James A. McMaster, who brought the *Freeman's Journal* to national prominence in his 38-year tenure; and the brilliant Maurice Francis Egan. The *Pittsburgh Catholic*, begun in 1844 by Bishop Michael O'Connor, was still vigorously edited in 1948. *The Mirror* (Baltimore), was started in 1849 and continued until 1908. Two St. Louis papers, the *Western Watchman* (1865) and *Church Progress* (1878) persevered until 1933 and 1926. The famed poet-priest, Abram Ryan, edited the *Banner of the South* at Augusta, Ga., before the Civil War, and also *The Morning Star*, founded in New Orleans, La., in 1867 and published until after 1920. *The Tablet*, New York, continued

from before the Civil War to 1890 and had Orestes A. Brownson as an editor.

The west coast emerged: *The Monitor*, San Francisco (1858), remains (1948) in lusty health; the *Catholic Sentinel*, Portland, Oreg., (1870) likewise continues. A notable founding was that of *The Catholic Citizen* (later the vigorous *Catholic Herald-Citizen*) of Milwaukee (1870), which mothered the first system or chain of Catholic papers in the country, evolving a group in cities as widely separated as Minneapolis, Memphis and Washington, D. C. In 1874 there was established the *Catholic Universe* of Cleveland (afterward the strong *Catholic Universe Bulletin*), which likewise produced a chain of several papers under the parent company of the Catholic Press Union. Among other prominent survivors of the period are: *The Standard* of Philadelphia (1866), subsequently the influential *Catholic Standard and Times*; *Catholic Union* (later *Union and Echo*), Buffalo, (1872); *The Providence Visitor*, Providence, (1873); *The Catholic Transcript*, Hartford, (1876); *The Record*, Louisville, (1879); *The Catholic Messenger*, Davenport, (1882), and *The Michigan Catholic*, Detroit, (1883). Foreign language survivors include *Der Wanderer*, St. Paul, (1867); *Hlas* (Bohemian), St. Louis, (1871); *Revista Católica*, El Paso, (1875), and *Polish Nation*, Chicago, (1876).

Magazine efforts have left as survivors some of the most telling and scholarly periodicals of our time, including the excellent *Catholic World* of New York (1865), leading literary publication, established by Isaac Hecker, founder of the Paulists, and press apostle; *Ave Maria* (1865), launched by Edward Sorin, C.S.C. of Notre Dame, Ind., and the Jesuit *Messenger of the Sacred Heart*, New York (1866).

Third Period (1885-1919).—The Catholic press now began organizing for the solution of problems, made appraisals, and girded itself for what was to be a strong and concerted surge forward. The newspapers continued expansion, but with increasing caution. The magazines actively extended their numbers and importance. Once again there was a determined anti-Catholic disturbance—the vicious American Patriotic Association (A.P.A.) onslaught in the 1890's. Catholic editors rose once again to effective battle. In the new century, however, attention was more and more centered on news coverage, literary development, and sounder foundations.

There began in this period an insistent self-criticism which has since been typical of the Catholic press, and has brought distinct benefits. This healthy attitude led to efforts to form groups for mutual help. An association was attempted following the Catholic Lay Congress of 1889, but with indifferent success; a Catholic editors' convention was held in Chicago in 1893; and in 1905 a Catholic Associated Press was essayed but failed. In 1911, at Columbus, there finally was founded the Catholic Press Association of the United States and Canada, a significant development in the history of this press. The C.P.A. took as its first activity the organization of a news agency. While, for lack of resources, this did not develop in nine years beyond a "letter" service from three world capitals, and brief weekly cable dispatches from Rome, it did constitute a beginning and was the precursor of the widespread National Catholic Welfare Conference (N.C.W.C.) News Service. The associ-

ation has done other constructive things to advance the Catholic press. It developed a Circulation Vigilance Committee which did effective work in keeping dishonest solicitors from the magazine field. Under Simon Baldus of *Extension Magazine* (one of the leading editors of the time and afterward president of the C.P.A.), the association created a Literary Awards Foundation, the financial prizes of which were to encourage the development of Catholic writers. It provides a liaison between Catholic publications and their news service; conducts the *Catholic Journalist* in the interest of the Catholic press; and its conventions and sectional meetings make possible the interchange of ideas.

For the entire period of 34 years the total of newspapers surviving was 57, as against 20 for the previous period of 44 years. Nicholas Gonner in 1899 established *The Catholic Tribune* of Dubuque, which in 1920 produced the "first and only English Catholic daily in America" with any endurance. The paper eventually became the *Catholic Daily Tribune*, which survived until 1942. The Catholic Press Union of Cleveland in this period undertook the publication of papers for other dioceses. There also were established the *Catholic Register* of Denver, (1910) and *Our Sunday Visitor* of Huntington, Ind., (1912), which were to create impressive chains of papers in a later period. *Our Sunday Visitor* was launched by John F. Noll (later bishop of Fort Wayne, Ind.) to counteract directly the influence of such rabidly anti-Catholic weeklies as *The Menace*. It attained an impressive national circulation and retains (1948) a commanding position. A few of the other newspapers established in this period (some of which are leaders of the Catholic press) are: *The Catholic News*, New York, founded in 1886 by Hermann Ridder and once edited by the celebrated historian John Gilmary Shea; *The New World*, Chicago, (1892), with Charles J. O'Malley once its editor; *The Tidings*, Los Angeles, (1895); *The Catholic Northwest Progress*, Seattle, (1898); *The Tablet*, Brooklyn, (1908); and *The Catholic Review*, Baltimore, (1913).

The Society of Jesus established in New York in 1909, *America*, the first weekly Catholic publication of opinion in the country. It was edited by John J. Wynne, S. J., and developed an international prestige. The important *Young Catholic Messenger* began at Dayton in 1886, and issues several highly successful journals for school children. Magazines founded in this period and still published (1948) reach the impressive number of 99.

Modern Period (1920—).—In World War I, the bishops promptly created the National Catholic War Council, which earned high admiration for its great service to morals and morale in the war. At the conclusion of the war, the bishops immediately revised this organization for peacetime efforts. The National Catholic Welfare Conference, which they then organized as their central episcopal agency, had an epochal effect on all American Catholic activity. An able and distinguished journalist, Justin McGrath, was obtained as director of the N.C.W.C. Press Department. He organized it and conducted it energetically until his death in 1931. At once a program was drawn up which envisioned for Catholic journals services of news, features, and pictures such as had long been available to the general press of America. The C.P.A. readily turned

over its own abbreviated news service. The department under McGrath and his successor, up to the year 1948 developed the following facilities: (1) A news service of approximately 50,000 words a week, reporting promptly from all parts of the world news of interest to Catholics as Catholics; (2) a Catholic feature service of about 10,000 words a week, designed to interest all members of the Catholic family; (3) a Catholic news picture service providing illustrations for current Catholic news; (4) a telegraphic service to flash last-minute news to subscribers; (5) an editorial information service supplying factual material for editorial writers; (6) a biographical service presenting life sketches of prominent Catholic figures; (7) a Washington letter, interpreting national events of particular interest to Catholics; (8) special texts of important Vatican documents, radioed immediately upon their issuance; (9) special syndications of articles on subjects of high timeliness and interest; and (10) special supplements—budgets of features, fiction, poetry, and pictures to assist publications with special editions at appropriate seasons. There also had been created an Overseas Service for publications abroad.

While the N.C.W.C. News Service was originated to strengthen the American Catholic press, in 1948 it had subscribing publications in 43 countries. In the early 1940's it began issuing *Noticias Católicas*, an adaptation of its news in Spanish and Portuguese, for Latin American publications. The news service speedily was accorded recognition. Members of its staff are accredited in the press galleries of Congress and in the White House press conferences, two groups zealously limited to professional journalists. Many of its reporters were accredited officially as war correspondents in World War II. Newspapermen of thorough experience constitute the headquarters staff and correspondents in world capitals and in the United States. The service has registered notable news beats. In World War II it obtained exclusively the textual documents of the German, French, Austrian, Dutch, and Belgian hierarchies resisting the Nazis. This material was used by the United States government and eventually printed in book form.

A strong and steady increase of papers succeeded the launching of the N.C.W.C. News Service. The stream of new enterprises cannot be enumerated here, but in 1948 there were 95 diocesan organs.

The Catholic newspaper experienced many sharp changes. Its world and national news content was multiplied; varied features were added; the use of pictures increased rapidly; and comic strips and cartoons lent variety. The paper became more informative and gave its readers more general fare. It came to depend less on the personality of its editor. When the next recrudescence of anti-Catholicism appeared with the Ku Klux Klan in the 1920's, the Catholic press took the visitation in its stride; there was effective editorial resistance, but the papers continued to fulfill their main mission of providing news, instruction, inspiration, and entertainment. Trained lay journalists began coming into the field in increasing numbers as managing editors. General, business, advertising, and circulation managers were added in many instances. This made for more professional management and thus financial soundness. Magazines soared in number and circulation. Between 1920 and 1945, there were

founded 110 that were still being published in the latter year. Preponderantly, the newspapers are weeklies; the magazines, monthlies. Circulations of individual newspapers in 1945 had advanced beyond the 100,000 mark, and many had 40,000 to 80,000 subscribers. The circulation of one Catholic magazine was approaching a million; other magazines were near the half-million mark and many were beyond 100,000.

Important new newspaper chains developed. The pioneer *Citizen* group was disbanded in 1934, but the Catholic Press Union was publishing three individualized diocesan organs with a circulation of approximately 100,000. In 1929, the Catholic Publishing Society of Denver, already issuing the *Denver Catholic Register* and the successful national *Register*, began a system of supplying official organs for other dioceses, that in 1948 spread to 32 sees, including such centers as Cincinnati, St. Louis, and Santa Fe, and extending from California to Pennsylvania, and from Tennessee to Montana. The driving force in this campaign was a newspaperman who had entered the priesthood—Msgr. Matthew Smith. He built a great publishing plant and even created his own school to train those who would be editors of his far-flung journalistic endeavors. In 1947 the group reported a circulation of near 650,000. The second most widespread system was that of *Our Sunday Visitor* Press. After making a striking success of its national weekly (chiefly of apologetical and instructional character), setting up a large pamphlet-issuing agency, and beginning the publication of a home (Fort Wayne diocese) newspaper, in 1940, *Our Sunday Visitor* went into individual territories and shortly had extended to its tenth diocese. This agency in 1947 reported a circulation of 664,429, for its national weekly and its diocesan editions. *Catholic Action of the South*, New Orleans (established in 1932) began founding editions for three neighboring dioceses in 1938.

The Bulletin, Augusta, (1920) brought a new note. Controlled by the Catholic Laymen's Association of Georgia, it developed, in a wave of anti-Catholic bigotry, its own technique of applying patient, corrective truth. Its remarkable service continues (1948).

Foreign language publications were established despite the difficulties of the times. In 1947, there were two Polish dailies, one Bohemian, and one Lithuanian. Of all foreign language Catholic periodicals, there were 17 Polish, 12 Bohemian, 9 French, 9 German, 5 Slovak, 4 Spanish, 4 Lithuanian, 3 Italian, 3 Croatian, 3 Slovenian, 2 Hungarian, 2 Ruthenian, 2 Ukrainian, and 1 Russian.

Following are some of the remarkably varied fields encompassed by Catholic magazines in 1948: antiprofanity, arts and crafts, Biblical studies, the blind, catechists, Catholic action, chaplains, charities, church goods, church music, church property, clergy, converts, the deaf, deaf mutes, ecclesiastical law, education, family, farm life, fraternal organizations (men and women), girls, history, Holy Land, Indians, interracial justice, journalists, libraries, liturgical arts, missions (foreign, home, medical), Negroes, opinion, parish life, peace, philosophy, physicians, poetry, religious instruction, school children, school editors, shrines, social justice, sodalities, stagecraft, temperance, theater, theological studies, war veterans, women, and workers.

A few of the magazines existent in 1947

were:

The Messenger of the Sacred Heart, New York (1866), circulation 301,144; *Annals of the Holy Childhood*, Pittsburgh (1870), 266,000; *Crusader's Almanac*, Washington, D.C. (1886), 262,000; *Orphan's Messenger and Advocate of the Blind*, Jersey City, N. J. (1890), 120,000; *The Catholic Forester*, Chicago (1892), 133,000; *Columbia*, New Haven (1893), 650,000; *St. Anthony Messenger*, Cincinnati (1893), 310,000; *The Victorian*, Lackawanna, N. Y. (1894), 167,700; *Extension Magazine*, Chicago (1905), 486,000; *Field Afar*, Maryknoll, N. Y. (1906), 420,000; *Catholic Missions*, New York (1907), 800,000; *Far East*, St. Columbans, Nebr. (1918), 162,893; *The Sign*, Union City, N. J. (1921), 181,000; *The Vincentian*, St. Louis (1923), 160,000; *Jesuit Missions*, New York (1927), 125,000; *The Catholic War Veteran*, New York (1935), 150,000; *The Catholic Digest*, St. Paul, Minn. (1936), 275,000; *Leaves*, Detroit (1938), 125,000; *The Fraternal Leader*, Batavia, N. Y., 100,000. *The Young Catholic Messenger*, leading juvenile, had an impressive 426,177.

Professional journals in particular fields were established chiefly since 1910. These include:

Ecclesiastical Review (1889), *Catholic Educational Review* (1911), *Catholic Historical Review* (1915), *Catholic Charities Review* (1917), *Directory of Catholic Colleges and Schools* (1921), *Catholic Biblical Quarterly* (1939), all of Washington, D.C., and several fostered by the Catholic University of America; *Homiletic and Pastoral Review*, New York (1900); *Hospital Progress*, St. Louis (1920); *Catholic Library World*, Scranton, Pa. (1929); *The Linacre Quarterly* (for physicians), St. Louis (1932); *The Priest*, Huntington, Ind. (1945). Published studies and records of Catholic historical groups have done much to preserve Catholic history. *The Communal* (1924), only American Catholic weekly of opinion by laymen; *The Interracial Review* (1928), and *The Catholic Worker* (1933), are published in New York. *Catholic Action*, Washington, D.C. (1919), N.C.W.C. organ, deals largely with the general activities of the hierarchy. *The Catholic Digest*, St. Paul (1936), is of comparatively new type and is published also in other countries in various languages, as well as in braille. *Timeless Topics*, St. Paul (1942), is a counter-publication to the comic-strip book, with a circulation of 300,000.

For journalistic education under Catholic auspices, five Catholic universities and colleges offer professional courses, and 50 others give cultural or supplementary instruction in the field.

Besides those mentioned, other agencies and organizations lending aid to the Catholic press include: the Catholic School Press Association, issuing *The Catholic School Editor*; the Catholic Poetry Society of America, with its own journal; the Gallery of Living Catholic Authors, providing a reward for those Catholics attaining prominence in letters; the annual *Catholic Press Directory* and the semiannual *Catholic Periodical Index*, both issued in New York. February is the annual Catholic Press Month, set aside to advance interest in and reading of Catholic publications.

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FRANK A. HALL,

Director, National Catholic Welfare Conference News Service.

CATHOLIC EMANCIPATION ACT, adopted by the British Parliament in 1829, removed such "qualifications for sitting and voting in parliament" as had prevented Catholics from enjoying political equality in that respect with other subjects of the crown. In 1828, the nom-

inal exclusion of Protestant dissenters and the actual exclusion of Catholics from offices under the crown and in local government had been voided by the repeal of the Test and Corporation acts. The prime minister, the duke of Wellington, then recommended the act of 1829 for passage in order to meet the demands of Catholics. He so moved under threat of a revolution in Ireland, where the peasantry had shown their independence by electing Daniel O'Connell to Parliament in 1828, despite the fact that he was, as a Roman Catholic, not entitled to serve. Although full religious equality was not established (for example, Catholic marriages were still illegal, and Catholics in the army and navy were still required to attend Protestant services), the act of 1829 was a true emancipation in that it opened places to Catholics in the sovereign legislature. All that was required was that they take an oath disclaiming any opinion that "princes excommunicated by the see of Rome may be deposed or murdered by their subjects or by any person whatsoever."

Numerous measures looking to political equality had been taken earlier. In the middle of the 18th century, it could still be said that "the law does not suppose any such person to exist as an Irish Roman Catholic except for repression and punishment," despite the fact that Catholics constituted four fifths of all Irishmen; English Catholics were a tiny minority liable to forfeiture of property or, in the case of their clergy, subject to imprisonment for life, depending upon the whim of some informer who might choose to invoke the laws against the administration of the sacraments; and the Scottish Highlanders were undergoing, as Catholics and rebels, further persecution for their participation in the Stuart uprising of 1745. But even then there had begun a gradual modification of law and practice by which the Parliament in Westminster, and the Irish Parliament in Dublin, as well as judges and administrators in both kingdoms, introduced successive modifications of repressive practices.

In 1774, the British government had found it necessary to accord recognition to the Catholic Church in Canada, where the French inhabitants constituted a major portion of the population. In the same year the Irish Parliament admitted that Irish Catholics could be loyal subjects of the crown when a new oath of allegiance was provided for them. The same law permitted Catholics, for the first time since the reign of Queen Anne, to acquire and transfer titles to land, and it abolished the right of an heir who turned Protestant to take over the whole of an estate so as to exclude Catholic sons and reduce the father's interest to that of a mere life tenant.

Other disabilities and incapacities were removed then and subsequently, up to 1793, such as the exclusion of Irish Catholics from the professions and from any profitable business. The right to vote was conceded in 1793—even to the peasantry who qualified as "forty-shilling freeholders."

Among the influential advocates of the rights of Catholics was that friend of America, Edmund Burke, whose mother had been Catholic. Burke voiced opinions which were in harmony with the aims of the Whig opposition to George III's government. The Whigs, constituting a strong economic influence in both kingdoms, included a powerful body of absentee landlords who hoped to increase their influence in the Irish Parliament

as against the crown influence. It was also characteristic Whig doctrine to espouse broad principles of religious toleration, to assuage religious passions in the interest of economic progress. On the other hand, the administrators of the crown interest in Ireland found it increasingly difficult to avert legislative crises without resort to more and more corruption in Parliament, which after 1782 could proceed with any measure without the prior approval of the Privy Council in England. If the further extension of rights to Catholics were to include full participation in political activity, the government's task would become impossible. Hence the clique of officeholders associated in name with Dublin Castle, having reluctantly agreed to the removal of most of the remaining social inequalities for Catholics in 1793, continued stubbornly to oppose the movement for granting full political rights.

The crisis came in 1794, when the Whig Earl Fitzwilliam (William Wentworth Fitzwilliam, 2d earl) became lord lieutenant. He sought to introduce Whig officeholders and grant Catholics the right to sit in Parliament, thus attaching them to the Whig interest. The Castle clique appealed desperately to their friends in England to do something. The king was reminded of his coronation oath—which he thought he would violate if he gave his assent to the proposed emancipation of Irish Catholics—and the Fitzwilliam administration was ruined. Revolution broke out in 1798, but was crushed by a Protestant militia which the Castle encouraged to many excesses. Nevertheless, the British government's desire to eliminate the separate legislature in Ireland induced it to make a pledge of emancipation to the Catholics, to follow Irish consent to a union of parliaments; and this was one of the numerous bargains by which there was arranged, in 1800, the extinction of the Parliament in Dublin. But George III refused to ratify any arrangements with the Catholics. He drove the responsible prime minister, William Pitt, from office, and after several years of conflict with the Whigs, who tried to force him to honor the pledge made in his name, the king emerged triumphant in 1809 with a ministry dedicated to the upholding of the Protestant ascendancy in both countries.

Repression in Ireland, and the antiliberalism promoted by opposition to the French Revolution during the Napoleonic Wars which lasted until 1815, made the prospect of Catholic emancipation as unlikely as any of the reforms which had been urged before 1793. Nevertheless, as successive reconstitutions of the English government took place after 1812, places among the ministers came to be filled by those who were known to favor what George III had sternly forbidden before he became insane in 1810 and was confined. His successor, first as prince regent and then (1820-1830) as George IV, was in harmony on this point with his most reactionary advisers. Catholics in England split with those in Ireland on the question of the exact form in which they might be "embraced within the constitution" (the matter of governmental controls over episcopal appointments caused particular trouble), and this made the rejection of various bills easier whenever some private member introduced them in Parliament. But agitation in Ireland, which by the 1820's was in a ruinous economic condition, forced action upon an unwilling Tory government. The brilliant leadership of O'Connell, who had the support of the Catholic clergy, produced the

first democratic pressure group in the form of the Catholic Association. When a disciplined peasantry showed that it could, when called upon, defy the landlords who were supposed to control their votes, and even gave these votes to O'Connell, and when attempts to outlaw the association only caused its revival under a different guise, it was recognized in England that political control of Ireland would soon be impossible. At length, and with bad grace, the duke of Wellington was persuaded to make concessions in the manner of a general executing strategic withdrawals. The act received the royal assent April 13, 1829, having passed through Commons and Lords by large majorities; but the spirit in which these majorities acted was revealed by the simultaneous passage of a bill to disenfranchise the forty-shilling freeholders in Ireland, and by the refusal to admit O'Connell to the House of Commons until he was re-elected.

Consult Hughes, P., *The Catholic Question, 1688-1829. A Study in Political History* (London 1929); Stephenson, C., and Marcham, F. G., *Sources of English Constitutional History* (New York, London, 1937); Woodward, E. L., *The Age of Reform, 1815-1870* (Oxford 1939).

JOHN T. FARRELL,
The Catholic University of America.

CATHOLIC EPISTLES, a group of seven letters in the New Testament which are addressed by apostles to the faithful in general; not to particular churches, as is that to the Philippians, that to the Ephesians, and the like, nor to individuals, as are the Epistles of Paul to Timothy and Titus. The catholic or general Epistles are those of James; I and II Peter; I, II, and III John; and the Epistle of Jude. These same Epistles are also styled canonical, signifying that they contain excellent rules (*canones*) of faith and morals.

CATHOLIC KNIGHTS OF AMERICA, a fraternal organization, founded in Nashville, Tenn., in 1877 and chartered under the laws of Kentucky in 1880. Its object primarily was mutual life insurance, but its scope was eventually extended to include the endeavor to unite fraternally all acceptable Roman Catholics of every profession, business, and occupation; to give all possible moral and material aid in its power to members of the organization; and to establish and maintain a fund for the benefit of the families of the members. The benefit fund is distributed according to well-established insurance rules. At first men only could become members; but since about 1901, women have been allowed admission on the same conditions as men, except the age limits for women are from 18 to 40, while the age limits for men are from 18 to 45. The executive power is vested in the Supreme Council (National) with headquarters in St. Louis, Mo., the state councils, and the officers of the local branches. In 1953 there were 259 branches in 32 states of the United States, with a membership of 13,018. This is the pioneer Roman Catholic fraternal organization in the United States.

CATHOLIC LIBRARY ASSOCIATION, an organization of about 2,000 librarians and other bookmen interested in the growth of Catholic libraries and librarianship. It includes members from the 48 states, the United States possessions, and 11 foreign countries. Headquarters, which

move with the change of the executive secretary, in 1954 were located at Maryknoll Seminary, Glen Ellyn, Illinois.

The idea of an organization of Catholic librarians was first conceived in 1921, when the Reverend Paul J. Folk, C.S.C., introduced a library section into the National Catholic Educational Association. This group met in annual convention with the parent organization for the next decade, until in 1931 it became independent under the leadership and first presidency of the Reverend William S. Stinson, S.J.

The growth of Catholic educational institutions in America, especially on the secondary and college levels, made it imperative that the new association move quickly to encourage and direct the training of librarians, to stimulate the intelligent planning of library buildings, and to promote the introduction of library science departments in Catholic institutions of higher learning. Though meager financial resources seemed to forebode failure such pretentious aims, the enthusiastic interest of the membership on an individual basis brought exceptional results. This is witnessed by the thousands of professionally trained librarians now supervising Catholic libraries, the multimillion-dollar library building programs in Catholic institutions, and the 25 Catholic colleges offering courses in library science.

The association, while organized on a national scale, is able to operate on the modest income of \$50,000 a year derived for the most part from dues and subscriptions—chiefly because of the contributed services of the membership. The organization is governed by an executive council of ten members chosen by general vote. As of 1954 there had been 30 national conventions of the association. Twenty-nine local units bring the benefits of the larger group to as many sections of the country through regional meetings, book fairs, and other bibliographical activities.

All types of libraries are represented in the association: public, university, college, secondary and elementary school, parish and hospital. Neither the libraries nor their librarians look to the association as a substitute for other library groups, such as the American Library Association, but as complementary to them, since it provides certain specialized services not available elsewhere.

Under the association's auspices have been published selected book lists of special interest to Catholic readers, both as independent works and as supplements to basic bibliographical tools; an *Alternative Classification for Catholic Books* and the *List of Catholic Subject Headings* have greatly aided librarians in both secular and religious libraries in the cataloging of the voluminous, technical Catholic literature. Another contribution is the *Catholic Periodical Index*. Begun in 1930, this quarterly index to over a hundred Catholic periodicals in all languages is the only religious index of its kind. The *Catholic Library World* published monthly and now in its 25th volume is the organization's official organ containing news of the field, proceedings of the national and local meetings, articles and book reviews bearing on the technical aspects of Catholic librarianship. An annual directory of the personal and institutional members of the association is issued as a supplement to the magazine.

Catholic Book Week, observed annually the last full week in February, provides the association with its most extensive contact with the public by means of posters and book lists aimed at stimulating good reading. See also **LIBRARIES—United States.**

VINCENT T. MALLON, M.M.,
Executive Secretary.

CATHOLIC MAJESTY, a title given by Pope Alexander VI to the kings of Spain, in memory of the complete expulsion of the Moors from Spain in 1491 by Ferdinand of Aragon. But even before that time several Spanish kings are said to have borne this title.

CATHOLIC MISSIONARY UNION, The, an organization of the Roman Catholic Church, was established to maintain and promote the missionary apostolate in the United States. Publishing, distribution of literature, and the training of missionaries for the mission field have been the chief activities of the organization. Formerly occupying the Apostolic Mission House on the campus of the Catholic University of America, the union has moved its quarters to St. Paul's College, the Paulist seminary in Washington, D.C., where lectures are held and courses in missiology for priests and seminarians are conducted. As a practical measure for accomplishing its purpose, the Catholic Missionary Union has placed special emphasis on the collection of funds. Financial assistance is given the bishops and superiors of religious communities in whose jurisdictions the mission work is carried on. The larger portion of these collections goes toward the support of missionaries working among the Negroes and Indians and to the support of activities in the poorer sections of the United States.

Organized by the Paulist Fathers, the union is controlled and operates through a board of directors whose president is always the archbishop of New York City. The distribution of funds is left entirely to the discretion of the board of directors.

CATHOLIC MISSIONS. See **MISSIONS, ROMAN CATHOLIC.**

CATHOLIC PARTIES, political parties in many continental European countries organized to defend the principles of Roman Catholicism in governments increasingly dominated by Socialist and other anti-Catholic forces. While having no official connection with the church, they have always enjoyed its support. The party in Germany, called the Center Party (*Zentrums-partei*), evolved from groups in the 1848 Frankfurt National Assembly and the Prussian Landtag of 1852 and held seats in Parliament from 1859. It waged the *Kulturkampf* (q.v.) contest with Bismarck; supported the Weimar Republic, and was suppressed by Hitler. In France no Catholic party existed during the Third Republic (1870–1940); but the Mouvement Républicain Populaire (MRP), organized in 1944, represents Catholic principles. Italy's Catholic Party (1905), renamed Italian Popular Party in 1919, was suppressed by Mussolini; after World War II it was reconstituted as the Christian Democratic Party. Catholic parties also exist in Belgium, The Netherlands and Switzerland; prior to Communist seizures, Czechoslovakia and Poland likewise had Catholic parties.

Since 1936 the National Union Party, a Catholic party, has dominated the Province of Quebec, save for an interval of less than five years (1939–1944) under Liberal Party control.

CATHOLIC PRESS OF AMERICA. See **CATHOLIC CHURCH, ROMAN.**—Section 6. *Catholic Press of the United States.*

CATHOLIC SEMINARIES. See CATHOLIC CHURCH, ROMAN.—Section 5. *Catholic Education in the United States.*

CATHOLIC UNIVERSITY OF AMERICA, an institution for higher education maintained by the Roman Catholic Church in the United States, at Washington, D.C. The need for a university in which instruction should be given and research conducted in all the departments of knowledge, under Catholic auspices, was recognized by the bishops assemblies in the Second Plenary Council of Baltimore (1866); and the establishment of such an institution was resolved upon in the Third Plenary Council (1884). Pope Leo XIII in 1887 approved the project, and granted the pontifical charter by the Apostolic Letter *Magni nobis gaudii* of March 7, 1889. The university was incorporated under the laws of the District of Columbia, and the city of Washington was selected as the site. The Right Reverend John J. Keane, then bishop of Richmond, Va., was designated rector of the university. In November 1889, academic work was inaugurated in the school of the sacred sciences. The schools of philosophy and social science were opened in 1895. There have been several reorganizations of the university with steady expansion of activities until the present scheme was established in 1937. The university now consists of the school of sacred theology, school of canon law, school of philosophy, school of law, college of arts and sciences, graduate school of arts and sciences, school of engineering and architecture, national Catholic school of social service, school of nursing education, school of social science, and summer sessions.

The "organic law" of the university is embodied in the statutes which were approved by the Holy See in 1937. It provides that the bishops of the United States shall have plenary authority in all matters pertaining to organization, instruction, or discipline. This authority is exercised by a board of trustees composed of bishops, priests, and laymen, who may elect new members and fill vacancies in the board. The chancellor, as the representative of the Holy See, presides at the meetings of the trustees. Subject to the authority of the trustees, the immediate government of the university is placed in the hands of the rector, assisted by the academic senate. The ex officio members of the senate are the rector, the vice rector, the secretary general, and deans of the faculties. In addition, each faculty elects one delegate to serve in the senate for two years.

The senate acting with the rector has competency in matters pertaining to the methods of instruction, the appointment of associate professors, and examinations for degrees. It proposes to the board of trustees such measures as may seem advantageous for the development of the university, and it recommends to the chancellor successful candidates for degrees.

The work of each school is in charge of a faculty composed of professors appointed by the board of trustees. The school comprises various departments in which courses are given by professors, associate professors, assistant professors, instructors, and occasional lecturers. The faculty makes recommendations to the rector who appoints officers—dean, vice dean, and secretary—and one delegate to the senate. It has a consultative voice in regard to the appointment or re-

moval of professors and, subject to the decision of the senate, draws up or revises courses of study, examines candidates for degrees, and makes recommendations for the development of the school.

University revenues are derived from endowments, donations for special purposes, tuition fees, and annual collections taken up in each diocese of the United States. A detailed statement of the receipts and expenditures is published yearly. There are 25 endowed chairs, 12 fellowships (nine founded by the Knights of Columbus, 1914), 216 graduate scholarships, and more than 100 undergraduate scholarships. The student body includes clerics and laymen, the former representing the diocesan clergy and religious orders.

The courses offered in the various schools of the university are for graduates only, the exceptions being in the school of philosophy, the school of engineering and architecture, the school of nursing, and in the college of arts and sciences. The college of arts and sciences is devoted entirely to undergraduate work, and the other schools just mentioned give courses for undergraduates and graduates. To be permitted to enter upon undergraduate work, a student must present the credentials regularly required by colleges and universities approved by the Middle States Association of Colleges and Secondary Schools.

Grouped about the university are the houses of study of many religious communities, notably:

Atonement Seminary, Augustinian College, Basselin Foundation, Benedictine Sisters, Capuchin College, Carroll House, Catholic Sisters College, Clarean Fathers, De La Salle College, Discalced Carmelite Fathers, Dominican House of Studies, Fathers of Mercy, Franciscan Friary, Franciscan Sisters of Christian Charity, Holy Cross College, Holy Family Seminary, Holy Ghost Fathers, Holy Name College, Holy Redeemer College, Holy Trinity Missionary Cenacle, Marian House of Studies, Brothers of Mary, Marist College, Oblates of Mary Immaculate, Oblates of St. Francis de Sales, Pallottine House of Studies, Queen of Apostles Seminary, Resurrection Scholasticate, Sacred Hearts Seminary, St. Anselm's Priory, St. Bonaventure Friary, St. Charles House of Studies, St. Gertrude's School of Arts and Crafts, St. Jerome's House of Studies, St. Joseph's Ukrainian Catholic Seminary, St. Joseph's Seminary, St. Paul's College, School Sisters of Notre Dame, Sisters of St. Joseph, Society of Medical Missionaries, Society of the Divine Word, St. Thomas More House of Studies, Third Order Regular of St. Francis, Trinity College, Viatorian Seminary, Vincentian Fathers, White Fathers of Africa, Whitefriars Hall (Carmelite).

The houses of other communities having connection with the university are located in Washington proper, and in the neighboring communities of Hyattsville and Silver Spring.

The Catholic Sisters College, established in 1911, serves as a residence for members of religious communities of women enrolled for study at the university.

Since 1911 a summer session has been offered by the university at Washington, and branches of this session restricted to work for the master's degree and in four or five fields only, in other parts of the country as follows: at San Rafael, California, since 1932; at Dubuque, Iowa, since 1934; at San Antonio, Texas, since 1935; and at Chicago, Illinois, since 1946. The enrollment for 1953 was distributed thus: Washington 2,770; San Rafael 92; Dubuque 94; San Antonio 120; Chicago 84.

In 1912, the university adopted a plan for the affiliation of colleges and high schools. Since then, it has been extended to include junior colleges, teacher-training institutions, and nurs-

ing schools. The aim of this plan is to furnish guidance to those institutions, and to assist them in meeting their individual problems.

The official publishers of the university are the Catholic University of America Press. Periodicals issued by the university include: *The Catholic Educational Review*; *The Catholic Historical Review*; *The Corpus Scriptorum Christianorum Orientalium*; *Studies in Psychology and Psychiatry*; *The New Scholasticism*; *The American Ecclesiastical Review* . . . Monographs; *Proceedings of the American Philosophical Association*; *Primitive Man and Publications of the Catholic Anthropological Conference*; *The Educational Research Monographs*; and *The Catholic University Bulletin*.

The university student enrollment for 1953-1954 numbered 3,385. The teaching staff comprised 408, including 60 professors.

Roy J. DEFERRARI,
Secretary General, Catholic University.

CATHREIN, kä-trin', Victor, Swiss Jesuit writer and sociologist: b. Brig, Wallis Canton, Switzerland, May 8, 1845; d. Aachen, Germany, Oct. 9, 1931. Educated at the Brig gymnasium, and at various Jesuit scholasticates, Cathrein entered the Society of Jesus in 1863, and in 1867-1869 was professor of German at the Belgian colleges at Antwerp and Verviers. During the Franco-Prussian War of 1870-1871 he cared for wounded French soldiers at Koblenz, but in 1872 was expelled from Germany under the law banning the Jesuit Order. Ordained to the priesthood in 1877, he was a member of the editorial staff of *Stimmen aus Maria-Laach* for three years, and from 1882 to 1912 was professor of ethics at Jesuit houses in Holland.

A prolific writer, several of his scholarly books achieved popularity and were often reprinted. Representative works include *Die englische Verfassung* (1881); *Recht, Naturrecht und positives Recht* (1900; 22d ed., 1909); *Moralphilosophie*, 2 vols. (1891; 5th ed., 1911); *Die Aufgaben der Staatsgewalt und ihre Grenzen* (1882; 10th ed., 1915); *Die katholische Weltanschauung* (6th ed., 1921); *Die dritte Internationale* (1921); *Der Sozialismus* (1890; 14th ed., 1923); *Sozialismus und Katholizismus* (1929); *Lust und Freude, ihr Wesen und ihr sittlicher Charakter* (1931).

CATILINE, kät'i-lin (LUCIUS SERGIUS CATILINA), Roman politician: c. 108-62 B.C. To Cicero's four speeches against him (*Orationes in Catilinam*) and to Sallust's essay on his plot (*De Bello Catilinae*) we owe most of our knowledge of his celebrated conspiracy against the Roman Republic.

Catiline, scion of an impoverished patrician family, first appears as a supporter of Sulla (q.v.), from whose proscriptions (82-81 B.C.) he profited. After the quaestorship in 70 B.C. and the praetorship in 68 B.C. he governed Africa as propraetor in 67 B.C. and returned in 66 B.C. to Rome, where his candidacy for the consulship of 65 B.C. was thwarted by his trial for provincial extortion. By bribery he bought his acquittal in 64 B.C. in time to seek the consulship for 63 B.C. Defeated at the polls, Catiline announced his candidature for 62 B.C. It was this renewed attempt that inspired his plot to seize control of the state.

Meanwhile Catiline's debauchery, daring, and

largess had won for him the championship of the most abandoned and desperate elements in Italy: criminals, gamblers, rakehells, debt-ridden nobles and peasants, restless veterans, ne'er-dowells, prodigals, perverts, who had nothing to lose and everything to gain from his program of a "new deal," which included cancellation of debts and confiscation of political enemies' property. Even some senators and ex-magistrates supported him in hope of financial profit. But, since too many persons were privy to the plot to elect Catiline consul by hook or crook for it to be kept a secret, news of it soon reached Cicero (q.v.), who, the more patriotic of the two consuls in 63 B.C., determined to prevent Catiline's election. Cicero first gained the neutrality of his colleague Antony (uncle of the future triumvir), who was suspected of favoring Catiline, and then he paid Fulvia, a courtesan and the mistress of a Catilinarian, to keep him informed of the plotters' plans.

By September Cicero had sufficient information, though not proof, to expose Catiline's conspiracy in the Senate, where Catiline defiantly denied Cicero's charges. This exposure induced the chief conspirator to twofold action: to start a revolt at Fiesole, headed by his lieutenant Manlius, who had gathered a crew of desperados there and who was to march on Rome on October 27; and to seize Rome on the next day during the balloting for offices by firing parts of the city and by murdering senators and aristocrats. But Cicero convoked the Senate on October 21, declared the details of the conspiracy, and secured the passage of the *senatus consultum ultimum*, a senatorial resolution putting the state under martial law for the duration of an imminent danger. This disclosure also decided the poll (held on October 28), since, as reports of Catiline's recklessness spread, sober citizens rallied in a heated election to reject his bid for the consulship.

Manlius started operations on schedule, but tarried in Tuscany, where he waited for final word. Catiline, since his plot had been bared and he had been rebuffed at the polls, altered his plan and arranged to assassinate Cicero on November 7 and then to seize the city. Cicero heard of the change in time and convened the Senate on November 8, when he denounced Catiline (*First Catilinarian*). Catiline attempted to answer this speech, but the senators silenced him with shouts. Threatening and cursing, he rushed from the session and during the night fled to Fiesole. On November 9 Cicero addressed the populace (*Second Catilinarian*), to whom he explained what had happened and what measures he was taking for their safety. When it soon was reported in Rome that Catiline had assumed the consular insignia at the conspirators' camp, the Senate voted Catiline a public enemy.

The plotters who remained in Rome prepared to fire the city, to massacre as many patricians as possible, and then to join Catiline on his anticipated approach with Manlius' army. At last proof of this plot came into Cicero's hands on December 3, when, through informants, he was able to capture signed and sealed letters from the conspirators to Catiline and to the chief of the Allobroges, a Gallic tribe, whose support the Catilinarians had hoped to secure. Five of the principal plotters, arraigned before the Senate and confronted with the evidence, confessed their guilt. Then Cicero again spoke to the people

(*Third Catilinarian*) and showed them how the incriminating proof had been secured. On December 5 they were condemned to death by an overwhelming vote of the senators, though Caesar (sometimes suspected of having used Catiline as a cat's-paw) advocated perpetual imprisonment. On this occasion Cicero delivered the last of this series of orations (*Fourth Catilinarian*), in which he urged capital punishment for the conspirators. On that evening they were strangled in the civic jail under the supervision of Cicero, who assumed the responsibility for their execution without a trial and under martial law.

Antony then led an army against Catiline's forces in Tuscany, where on Jan. 5, 62 B.C. his lieutenant Petreius in a bitter battle at Pistoia defeated the rebels, who, inspired by their leader's example, died almost to a man and "all with wounds in front" (Sallust).

Sallust's characterization of Catiline is memorable: "He had great mental and physical vigor, but a character evil and depraved. From his youth he engaged in murder, rapine, political discord, civil war. His body could endure hunger, cold, sleeplessness beyond incredible limits. His mind was bold, cunning, treacherous, capable of pretense and of concealment. He was covetous of others' wealth, but prodigal of his own, fiery in passion, quite eloquent, but less discreet. His undisciplined spirit ever craved the monstrous, the incredible, the gigantic. And he was incited by the corruption of public morality, which was being destroyed by mutually opposed evils: extravagance and avarice."

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P. R. COLEMAN-NORTON.

CATINAT, kâ-tê-nâ', Nicolas de, marshal of France: b. Paris, France, Sept. 1, 1637; d. St. Gratien, Feb. 25, 1712. He gave up the profession of law for that of arms, and attracted the notice of Louis XIV by his valor at the storming of Lille in 1667, which gained him promotion. By a number of splendid deeds he won the esteem and friendship of the great Condé (Louis II), particularly by his conduct at the Battle of Seniffe. Sent as lieutenant general against the duke of Savoy, he gained the battles of Staffarda, Aug. 18, 1690, and of Marsaglia, Oct. 4, 1693, occupied Savoy and part of Piedmont, and was made marshal in 1693. In the conquered countries his humanity and mildness often led him to spare the vanquished, contrary to the commands of the marquis de Louvois, minister of war. In Flanders he conquered Ath in 1697. In 1701 he received the command of the army in Italy against Prince Eugene, but here he was less successful. Destitute of money and provisions, and hampered by orders from court, he was defeated at Carpi on July 6, and at the Battle of Chiari on Sept. 1, 1701. In spite of the perfidy of the duke of Savoy, Catinat's representations at court were not believed and he fell into disgrace. From his unalterable calmness and consideration his soldiers called him "le Père la Pensée."

Consult his *Mémoires* (Paris 1819) and the biography by E. De Broglie (1902).

CATINEAU-LAROCHE, kâ-tê-ô' lâ-rôsh, Pierre-Marie-Sebastien, French politician: b. St. Brieu, Brittany, France, March 25, 1772; d. May 22, 1828. He studied at Poitiers and, to escape the French Revolution, emigrated to San Domingo (now Dominican Republic), where he published a journal, *L'ami de la paix et de l'union*. He was sentenced to death for the opinions he advocated but, by the timely assistance of the agents of the king of France, succeeded in escaping to Cape Francis (now Cap Haïtien), where he alone of 17 of his countrymen was saved from subsequent massacre in that city. He then visited the United States and England, and, on his return to Paris in 1797, prepared several dictionaries. His printing office was destroyed by fire, but the government employed him in various public capacities. In 1809, appointed secretary general of the commission houses, he was sent to Austria, and a year later was made inspector of Illyria. He became head of the Library Administration Bureau, served as secretary general of the Department of the Aisne, and prefect of St. Quentin. After a second visit to the United States he was commissioned to go to Guiana to study the climate and resources of that colony. His notes appeared in 1822. He became chief of the Bureau of Commerce and of the Colonies (1826) and commissary general of the interior (1828).

CATLETTSBURG, kât'lits-bûrg, city, Kentucky, seat of Boyd County, on the Ohio River at its confluence with the Big Sandy. It is on the Ohio and West Virginia borders, and on the Chesapeake and Ohio Railroad. Its industries include oil refining, chemical works, the manufacture of concrete products, and toys. Each June the American Folk Song Festival is held at "Traipsin' Woman's Cabin" which is nearby. The city was settled as a trading post in 1808 and has a mayor and council government. Pop. (1950) 4,750.

CATLIN, kât'lin, George, American traveler and artist: b. Wilkes-Barre, Pa., July 26, 1796; d. Jersey City, N. J., Dec. 23, 1872. After practicing as a lawyer for two years, he established himself in Philadelphia as a portrait painter and, in 1832, commenced special studies of the American Indians. He resided among them both in North and South America for many years. In 1840 he went to Europe, and subsequently introduced three groups of American Indians to European courts. His finely illustrated works are *Letters and Notes on the Manners, Customs, and Condition of the North American Indians*, 2 vols. (1841); *Catlin's North American Indian Portfolio . . .* (1845); *Catlin's Notes of Eight Years' Travels and Residence in Europe* (1848); *Life Among the Indians* (1867); *Last Rambles Amongst the Indians of the Rocky Mountains and the Andes* (1867). His 500 portraits from life of American Indians are now in the United States National Museum at Washington, D.C., constituting the Catlin Gallery. About 400 sketches are in the possession of the American Museum of Natural History, New York City.

Consult Miner, W. H., *George Catlin*, with an annotated bibliography of his writings (New York 1901); Haberly, Lloyd, *Pursuit of the Horizon* (Toronto 1948).

CATLINITE, kât'lin-it, a dull red indurated clay which was named for George Catlin (q.v.). It

occurs in Pipestone County, Minn., as a layer about 18 inches thick in quartzite. It has been manufactured by the Sioux Indians into pipes and various ornamental objects.

CATNIP or **CATMINT**, a hardy perennial herb (*Nepeta cataria*) of the family Menthaceae. Native to the Orient and Europe, it has spread to most temperate regions of the globe, including the Americas. Cats are especially fond of it, rubbing themselves upon it and eating it with relish. Catnip contains a fragrant volatile oil, for which it is sometimes used in cooking. It grows about two feet tall, bears heart-shaped greenish-white leaves and dense whorls of small purplish or rosy-white flowers.

CATO, kā'tō, **Dionysius**, reputed author of a Latin collection of moral maxims called *Dionysii Catonis Disticha de Moribus ad Filium*, though shorter titles appear. The author's aim was to inculcate courage, prudence, and moderation. The corpus, now reduced to 144 couplets in verse, with a preface and 56 proverbs, was cited first about 200 A.D. While various theories about its origin occur, most scholars suppose that between 117 and 324 A.D. the aphorisms were collected by an anonymous compiler and that Cato's name afterward was attached, because Cato the Censor had addressed sententious sayings to his son.

CATO, **Marcus Porcius** (known as **CATO THE CENSOR** or **CATO THE ELDER**), Roman soldier and statesman: b. Tusculum, near Frascati, Italy, 234 B.C.; d. Rome, 149 B.C. He also had the surnames of Priscus "the old-fashioned" or "the strict," and of Sapiens "the wise." The word Cato, derived from *catus* (sagacious), was first applied to him in the family, as his plebeian ancestors had been known simply as Marcus Porcius. The surnames Priscus and Maior were probably used later to distinguish Cato from his eminent great-grandson Marcus Porcius Cato Uticensis or Minor. In his boyhood Cato inherited from his father a small estate and there spent his adolescent years, until Hannibal's invasion of Italy incited the youth's patriotism. His first campaign was in 217 B.C., when he served under Quintus Fabius Maximus Verrucosus, the celebrated dictator, who later admitted Cato as an aide and schooled him in military science as well as indoctrinated him in political lore. Cato saw service at the sieges of Capua (214 B.C.) and of Tarentum (209 B.C.) and contributed to the decisive defeat of Hasdrubal at Sena Gallica on the Metaurus River (207 B.C.). During the winters, when belligerents rested, Cato resumed his labors on his farm and soon won local fame for his hardy mode of life, his sententious sayings, and his sound advice and decisions in local disputes. He soon attracted the attention of an influential neighbor, Lucius Valerius Flaccus, who belonged in Roman politics to the conservative and patrician party adhering to the old-fashioned, strict virtues of the ancient national character. Observing Cato's military record, eloquent speech, and homely rusticity, and knowing that all three assets were passports to a brilliant political career, Flaccus promised Cato his patronage if he would move to Rome and there enter politics. Cato accepted the offer and soon won recognition as an oracle of the austere, old-fashioned, religious-minded yeomen-citizen, who opposed the

sophisticated, intellectually refined, but morally degenerate element of Roman society, which had been captivated by Greek culture, then in its first flush of conquering Roman civilization.

In 204 B.C. Cato was chosen quaestor to Publius Cornelius Scipio—the victor over Hannibal at Zama—and assisted him in the transport of the Roman expeditionary force from Sicily to Africa. Cato took a dim view of Scipio's Hellenophilic conduct, extravagant expenses, and relaxed military discipline in Sicily, and denounced his general to the Senate. Though Scipio justified his management of the army and was acquitted, Cato's zeal in the cause of public interest increased his influence among the populace. Cato served as aedile in 199 B.C., and in 198 B.C. became praetor, obtaining Sardinia as his province. There he illustrated his principles by reducing official expenses, discarding pomp, installing an honest administration, and deciding cases with scrupulous impartiality.

When he returned to Rome in 197 B.C., Cato found that his reputation had preceded him and that at the age of 37 he had become a living legend for pure morality and antique virtue. His very faults—narrow patriotism, hostility to Greek culture (though he secretly studied Greek), old-fashioned practicality, rustic devotion to physical labor and to parsimony—carried the stamp of the national character and were pronounced to be virtues.

In 195 B.C. Cato attained the consulship and had Flaccus, his former patron, as his colleague. True to his principles, he resisted the rescission of the Oppian Law, passed in the dark days of the Hannibalic Wars to conserve money and materials, but was forced to yield to the popular protests that the flourishing conditions of the treasury warranted annulment of the law. Soon afterward he sailed for Spain to quell a rebellion. There he conducted such a vigorous and brilliant campaign that he soon reduced the peninsula to submission (though sullen and temporary as events proved), reformed its administration, and increased its revenues. His return to Rome in 194 B.C. was rewarded by a triumph. Cato's last military exploit was performed as legate of Manius Acilius Glabrio, consul in 191 B.C., during the war against Antiochus III of Syria, who had invaded Greece. Cato so distinguished himself at Thermopylae that Glabrio conferred much of the credit for the victory on him and sent him to report at Rome the successful conclusion of the campaign.

Henceforth Cato devoted himself to political warfare and, as a leader of the party opposed to Roman expansion in Greece and espousing the cause of the Italian peasant, he was active in senatorial debates, addressed the electorate frequently, and relentlessly pursued his opponents, particularly those who—according to his standards—had mismanaged provinces, or had been lax in accounting for military booty, or had been extravagant in expending state funds. Even if he did not directly intervene in the prosecution of the Scipios (Africanus and Asiaticus), it was certainly Cato who inspired the accusations of corruption made against them. Their political defeat enhanced Cato's position still further.

In 184 B.C. Cato achieved the acme of his ambition in obtaining the office of censor, wherein, with his old friend Flaccus as colleague again, he strove incessantly for moral, social, and economic reconstruction. One of the many anecdotes

illustrating his inflexible severity has it that Cato degraded from the Senate a praetor on the ground that he had kissed his wife in their daughter's presence. While some of his reform measures induced some obloquy and opposition, on the whole the people liked his performance and honored him with a statue and a laudatory inscription. Cato's last public commission was an embassy to Africa in 150 B.C. to decide a territorial dispute between Carthage and Numidia. He was so amazed at Carthage's rapid recovery from the last war and from its postwar losses to the Romans, that thereafter he ended every speech in the Senate—no matter on what subject he spoke—with the well-known sentence: "Moreover I vote that Carthage must be destroyed (*Praeterea censeo Carthaginem esse delendam*)."

He lived another year to see the outbreak of the Third Punic War which his voice had instigated.

Cato was married twice and had a son by each wife. His conduct as husband and father was equally exemplary, but he was a harsh master to his slaves, whom he chastised for trifling negligences and killed for graver offenses. Such brutality was, however, characteristic of his generation.

Cato also found time to write and, because the works of earlier writers have been largely lost, he has been called the father of Latin prose. We have: (1) fragments of his orations; (2) most of his treatise *De Agricultura* or *De Re Rustica*, containing miscellaneous materials on domestic and rural management; (3) many portions of his *Origines* in seven volumes, which traced Rome's history from the beginning to the year of his death; (4) some scraps of letters to his elder son, for whom he used this literary genre to discuss subjects suitable to a Roman youth's education.

Lives of Cato, written by Cornelius, Plutarch, and Sextus Aurelius Victor, survive and are supplemented by information gleaned from the historian Livy and from Cicero's *Cato Maior*, a dialogue wherein Cicero has Cato discuss old age, and *Brutus*, another dialogue in which Cicero characterizes Cato's oratorical style. All these, save Victor's brief sketch, are conveniently edited and translated in the Loeb Classical Library.

Bibliography.—Catonian fragments are edited by Hermann Peter, *Historicorum Romanorum Reliquiae*, vol. 1, pp. cxxvii-clxvii, 51-94 (Leipzig 1870); by Henrica Malcovati, *Oratorum Romanorum Fragmenta*, vol. 1, pp. 172-153-218 (Turin 1930); by Ernest Brehaut, *Cato the Censor on Farming* (New York 1933).

Consult Graves, J. T., "Cato" in *A Dictionary of Greek and Roman Biography and Mythology*, ed. by William Smith, vol. 1, pp. 635-644 (London 1880), still unsurpassed as the best biographical sketch in English; Corte, Francesco della, *Catone Censore* (Turin 1949); Marmorale, Enzo V., *Cato Maior*, 2d ed. (Bari 1949); Duff, J. Wight, *The Literary History of Rome*, rev. ed., vol. 1 (New York 1953), where the index for references to Cato, scattered throughout the work, should be used.

P. R. COLEMAN-NORTON,
Princeton University.

CATO, Marcus Porcius (surnamed UTICENSIS from Utica, place of his death), Roman patriot and Stoic philosopher; b. Rome, Italy, 95 B.C.; d. Utica, North Africa, 46 B.C. He was also known as Minor and the Younger to distinguish him from his great-grandfather Cato the Censor. Bereft of his parents in childhood, Cato was reared by his uncle first, then was educated by Greek tutors. Anecdotes about his boyhood confirm the adage that the child was the father of the man. Incorruptible, devoted to his concep-

tion of duty, simple and austere, practicing the strictest principles of Stoicism, rigidly republican in politics, consciously imitating his great ancestor, Cato represented during the degenerate and dying days of the free republic the old-fashioned virtues which had formed Romans into heroes.

Cato's earliest public appearance was against plebeian tribunes who were attempting to alter a basilica built by Cato the Censor, and in pleading his case he displayed that powerful eloquence which later made him so formidable. His first military campaign was in 72 B.C., when he volunteered in the Servile War against Spartacus. In 67 B.C., as military tribune, he commanded a legion in Macedonia, but saw little action. Elected quaestor in 65 B.C., he so honestly and efficiently conducted his office that the treasury was richer at the end of his tenure. Cato, who had inherited a large patrimony, spent the next year in travel in the province of Asia Minor, where he refused any offers of gifts to win his influence in the provincial interests. In 63 B.C. he won the election as one of the plebeian tribunes; the year was marked by the conspiracy of Catiline. Cato supported Marcus Tullius Cicero in proposing the death penalty for the plotters and his eloquence in the Senate turned the tide of votes, which had drifted toward Gaius Julius Caesar's proposal for life imprisonment. The Catilinarian conspiracy was only one symptom of gangsterism soon to ruin the republic. Cato and Cicero inveighed against prevailing political corruption and opposed the first triumvirate composed of Caesar, Gnaeus Pompeius Magnus, and Marcus Licinius Crassus, who secured control of the state in 60 B.C. To remove Cato from Rome the triumvirs sent him to add Cyprus to the provincial system; he occupied the island in 58 B.C. and accomplished his commission so efficiently that on his return he deposited in the treasury more money than any other provincial governor ever had.

About this time Cato's matrimonial life attracted public attention. Earlier he had divorced his first wife for adultery, after she had borne him two children. Later he remarried and became the father of three children. Now he amicably divorced his second wife for her to marry his friend Quintus Hortensius Hortalus, at whose death in 50 B.C. Cato received her into his home again.

Cato continued his fight against the triumvirs. Despite their opposition he finally gained (54 B.C.) the praetorship, highest office held by him. During his tenure he enforced the laws against corrupt electoral practices, thus alienating all parties, which considered it normal to buy and sell votes. He failed to attain the consulship because he refused to stoop to bribery. In 49 B.C., when the civil war between Caesar and Pompey began, Cato was appointed propraetor of Sicily, which he soon abandoned to the Caesarians' superior force in the hope that he could negotiate peace. He joined Pompey in Greece and had charge of his camp, while Pompey departed for his defeat at Pharsalia in 48 B.C. After the rout, Cato conveyed the republican remnants to Africa, where throughout 47 B.C. he assisted in rallying the forces against Caesar. When Caesar came to Africa to deal with the remaining republican army, Cato was left to hold Utica, while his colleagues marched bravely into the trap set for them by Caesar at Thapsus. All Africa, except Utica, then submitted to Caesar. Loathing life

under Caesar's despotism, Cato decided to die. After dinner, during which he talked about philosophy, he retired to his room and read Plato's discussion of immortality in the *Phaedo*. Then he stabbed himself. But his friends, awakened by his fall, ran to him and dressed his wound. When he recovered his senses, Cato removed the bandage, extracted his intestines, and thus died.

Besides Plutarch, whose biography (in the Loeb Classical Library) is our chief source, many ancient authors commemorate Cato, who became a popular subject of panegyric.

Consult Graves, J. T., "Cato" in *A Dictionary of Greek and Roman Biography and Mythology*, ed. by William Smith, vol. 1, pp. 645-650 (London 1880).

P. R. COLEMAN-NORTON,
Princeton University.

CATO, Publius Valerius, Roman scholar and poet: b. in Cisalpine Gaul, Italy, about 100 B.C. During the dictatorship of Lucius Cornelius Sulla (81-79 B.C.) and the confusion caused by the proscriptions, he lost his estate and went to Rome as a needy student. His talent as a critic and grammarian of the Alexandrian type eventually won him credit and distinction. Little of his works are extant; contradictory opinions exist as to whether two poems *Dirac* and *Lydia* should be attributed to Cato or to Virgil (q.v.).

CATO, the title of two noted 18th century plays: (1) A blank verse tragedy by Joseph Addison in five acts. It was first presented in 1713. The scene is laid in a hall of the governor's palace at Utica. The subject is Cato's last desperate struggle against Caesar and his determination to die rather than survive his country's freedom. *Cato* owed its extraordinary success to the deadly hatred that raged between the Whigs and Tories at the time: the Whigs cheered when an actor mentioned the word "liberty"; and the Tories, resenting the implied innuendo, cheered louder than they. To the Whigs the duke of Marlborough was a Cato, to the Tories he was a Caesar. Every poet of the time wrote verses in honor of *Cato*, the best being Alexander Pope's prologue; and it was translated into French, German, and Italian. (2) A tragedy, *Cato in Utica*, by Pietro Metastasio, in 1727. The author follows closely the historic accounts of Cato's relations with Caesar, and the details have more probability than those of Addison. He shows a decided superiority to Addison in making Caesar the principal figure next to Cato and in contrasting them constantly with each other.

CATO STREET CONSPIRACY or **THISTLEWOOD CONSPIRACY**, in English history, a plot formed in 1820 to murder the foreign secretary, Lord Castlereagh (Robert Stewart), and other cabinet ministers, and to form a provisional government. The leader of the conspirators was Arthur Thistlewood. The plot was discovered and several of the conspirators captured on February 23, when they had assembled in a stable on Cato Street and were preparing to carry out their intentions. Thistlewood, who escaped, was arrested the next day. After a trial in which they were defended by John Adolphus, Thistlewood and four others were executed, and five were transported.

CATONSVILLE, kă'tūnz-vīl, unincorporated village, Maryland, in Baltimore County, alti-

tude 500 feet, a residential suburb of Baltimore. Originally called Johnnycake, it was settled in 1729 and renamed about 1800. It is the site of the Spring Grove State Hospital for the Insane, of St. Charles College (1830; men), and of Mount de Sales Academy (1852; girls). John Wilkes Booth was a student at Catonsville Military Academy, 1851-1852. Pop. (1950) 29,638.

CATOPTRICS, kă-tōp'trīks, that branch of optics which explains the properties of incident and reflected light, and particularly that which is reflected from mirrors or polished surfaces. The whole doctrine of catoptrics rests on the principle that the angle of incidence is equal to the angle of reflection and in the same plane.

CATORCE, kă-tōr'sā, town, Mexico, in the State of San Luis Potosí, 15 miles west of Matehuala, situated on a barren spur of the Sierra Madre 9,045 feet above sea level, and containing some of the most valuable silver and antimony mines in Mexico. The town received its name, signifying 14, from a gang of robbers, formerly a constant menace to its inhabitants. There is also some mining of gold, lead, and copper, and the town's population varies greatly according to the demands of various minerals, sometimes leaping to 40,000 inhabitants. The railroad station, connecting the town with San Luis Potosí, which is 108 miles to the south, is 6 miles west of Catorce. Pop. (1940) 753.

CATOSTOMIDAE, kăt-ō-stōm'ī-dē, the suckers, a family of fishes of the order Eutrogna, to which many of the fresh-water fishes of the world belong.

This family has about 100 species in North America, with one species in Siberia and at least one in China. The shape of the body varies from thick and heavy to long and slender. The scales are smooth-edged, the head scaleless, and the jaws toothless, with the mouth so constructed that it can form a tubelike sucker through which food, consisting of plants and small animals, is drawn from the bottom of lakes and streams, the chosen habitat. The largest are the various buffalo fish, which may reach three feet in length.

A considerable fishery of suckers exists, centering along the Great Lakes and adjacent streams. They are taken commercially in gill and trap nets and afford some sport fishing. During spawning migrations into the shallow waters of lakes and streams, many are speared. The flesh, though bony, is sweet.

Consult Eddy, Samuel, and Surber, Thaddeus, *North-eastern Fishes* (Minneapolis 1947); Hubbs, Carl L., and Lagler, K. F., *Fishes of the Great Lakes Region* (Bloomfield Hills, Mich., 1947).

C. W. COATES.

CATRAIL (also known as the PICTS' WORK or PICTS' WORK DYKE), the name applied to the remains of a large earthwork in Scotland, about 48 miles in length, which, beginning at Torwoodlee Hill, near the junction of the Gala Water with the Tweed, runs with a semicircular sweep southward through the counties of Selkirk and Roxburgh to a point under Peel Fell, in the Cheviots. The trench ordinarily is 20 feet wide and 3 to 4 feet deep, with a rampart on each side, and the excavated earth lies usually on the lower side. Various causes have resulted in the destruction of the ramparts in many places. The origin of the Catrail has led to much

speculation, but is now supposed to have been a line of defense raised by the Britons against the invading Saxons.

CATS, *käts*, **Jakob**, Dutch poet: b. Brouwershaven, Zeeland, Nov. 10, 1577; d. Zorgvliet, near Scheveningen, Sept. 12, 1660. He studied at Leyden, Orléans and Paris. In 1627 and 1631 he was ambassador to England, and from 1636 to 1651 grand pensioner of Holland. His poetry is unimaginative and didactic, but has been extremely popular with the Dutch middle class by whom he is frequently affectionately alluded to as "Father Cats." A statue has been erected to him at his birthplace. His works consist of allegories, according to the taste of his times, poems on the different ages and situations of life, idyls, and the like. Among the most noted are *Het Houwelyck* (1625); *Sinne-en Minnebeelden* (1618); *Trouwingh* (1637); *Maegdenplicht* (1618); *Selfstryt* (1620); *Spiegel van den ouden en nieuwen tydt* (1632); *Faces Agustae* (1653).

CAT'S-EYE, the name given to several hard semitransparent stones used as gems, which, when cut in a certain way, show a line of light giving what is called a chatoyant effect. The true cat's-eye is a chrysoberyl of a greenish color, found in Ceylon and Brazil. The line of light shown when stone is cut *en cabochon* is due to the structure of the crystal, or to included impurities. The common cat's-eye, of little value, is a crystalline quartz sometimes containing fibers of asbestos, which, cut across the fibers, gives a chatoyant effect. It is found in Bavaria. Tiger-eye also shows the chatoyancy of the cat's-eye. Beautiful tourmaline cat's-eyes, rivaling the Oriental stones, have been found in California. Stones exhibiting the cat's-eye ray have been cut from various other minerals, including beryl, corundum, fibrous hornblende, bronzite, and hypersthene.

CATSKILL, *käts'kil*, village, N. Y., seat of Greene County, altitude 95 feet, 30 miles south of Albany, on Catskill Creek, on the west side of the Hudson River, and served by the New York Central Railroad. The Rip Van Winkle Bridge across the Hudson was completed in 1935. The village is a summer resort and gateway to the Catskill Mountain resorts. The Chase Memorial Law Library and St. Anthony's Seraphic Seminary (Franciscan) are at Catskill. The village manufactures women's wear and machinery, and ships apples and grapes, grown nearby. Catskill was settled about 1680 by Derrick Teunis van Vechten, whose homestead (1690) is still here. It is governed by a board of trustees. Pop. (1950) 5,392.

CATSKILL AQUEDUCT. See **AQUEDUCTS**.

CATSKILL GROUP, a name given to a great thickness of red, brown, green and gray conglomerates, sandstones and shales of which the Catskill Mountains are composed. Being well exposed by numerous cliffs and gorges, these deposits were carefully studied by the New York Geological Survey in the mid-19th century. The rocks were believed to constitute a series, having a definite place in the classification of the Paleozoic rocks worked out by the survey, and were

given the name Catskill. Subsequent investigation has shown that the Catskill is not even to be called a group. It is simply a succession of shoal-water deposits of Upper Devonian Age, which were laid down along one shore of an interior sea, while normal marine sediments, now represented by limestones, were being laid down elsewhere. Thus it happens that the Lower Catskill, of the Catskill Mountains, is represented elsewhere by limestones of the Hamilton stage, the Middle Catskill by the Portage and the Upper Catskill by the Chemung. In the Catskill Mountains the so-called Catskill series is 4,500 feet thick; and where thickest, at Mauch Chunk, Pa., it is 7,500 feet thick. Farther south the rocks thin out and disappear altogether in Virginia. Though having no standing as a rock group, the Catskill is of interest from its many resemblances to the Old Red Sandstone of England, made famous by Hugh Miller, and is of economic importance as containing some beds of excellent flags, quarried at numerous openings in Ulster, Greene and Delaware counties, N. Y., and sold as Hudson River bluestone. See also **DEVONIAN**; **OLD RED SANDSTONE**.

CATSKILL MOUNTAINS, a group of moderate elevation, part of the Alleghany Plateau, lying to the west of the Hudson River and situated mainly in Greene and Ulster counties, N. Y. The system covers about 1,400 square miles. The geological formation is very old, the mountains consisting of the shales and sandstone of the Catskill group of the Devonian system. The group contains several summits between 3,000 and 4,000 feet above sea-level. Slide Mountain, 4,205 feet, and Hunter Mountain, 4,025 feet, are the highest. The low lands along the creeks which drain the mountains and some uplands are cultivated. Many of the slopes form fine pastures; but the greater part is forested thickly with oak, ash, maple, beech, pine, and hickory. The pure atmosphere attracts eastern winter and summer visitors in large numbers, and the region is dotted with many resorts. Railways give access to many parts of the region. The Catskill watershed is a source of water supply for New York City.

CATT, *Carrie Lane Chapman*, American suffrage reformer: b. Ripon, Wis., Jan. 9, 1859; d. New Rochelle, N. Y., March 9, 1947. After graduating from Iowa State College in 1880, she studied law. Appointed principal of the Mason City (Iowa) High School in 1881, she became the city's first woman superintendent of schools two years later. In 1884 she married Leo Chapman, editor of the *Mason City Republican*. Shortly after her husband's death in 1886, she began to work for the woman suffrage movement, lecturing throughout the United States and Europe. In 1890 she was married to George W. Catt (q.v.). From 1904 to 1923 she was president of the International Woman Suffrage Alliance and served as president of the National American Woman Suffrage Association from 1915 until her death. In 1919 she founded the National League of Women Voters. Largely due to her organizing ability the 19th Amendment to the United States Constitution, enfranchising women, was adopted in 1920.

CATT, *George William*, American engineer: b. Davenport, Iowa, March 9, 1860; d.

1905. He was educated at the Iowa State College and subsequently studied engineering and law. He built government dry docks at the navy yards at League Island, Philadelphia, and Mare Island, Calif.

CATTANEO, Danese di Michele, Italian sculptor: b. Colonnata, near Carrara, 1509; d. Padua, 1573. He studied in Rome under Jacopo Tatti Sansovino (q.v.), and worked with him on sculptures in Venice. His own work there included the *Apollo* on the fountain in the Zecca, and the *Saint Jerome* in San Salvatore. In 1547 he completed the bust upon the tomb of Cardinal Pietro Bembo in the Sant' Antonio church at Padua. With Gerolamo Campagna, his pupil, he carved the tomb of Gian Fregoso in the church of Sant' Anastasia at Verona.

CATTARO, former name of a seaport in Dalmatia. See KOTOR.

CATTEGAT, a gulf between Denmark and Sweden. See KATTEGAT.

CATTELL, James McKeen, American psychologist: b. Easton, Pa., May 25, 1860; d. Lancaster, Pa., Jan. 20, 1944. He was graduated at Lafayette College in 1880, and studied at Leipzig, Paris, Geneva and Göttingen. He was professor of psychology in the University of Pennsylvania in 1888-1891 and professor of experimental psychology in Columbia University 1891-1896; from 1896 to 1902 head of the department of anthropology, and from 1902 to 1905 professor in the department of philosophy. He resigned in 1917. Besides publishing numerous papers on psychological subjects, he has edited numerous publications. He edited *The Psychological Review* (1894-1904) and *School and Society* (1915-1939), and he is editor of *Science* (since 1894), *The Scientific Monthly* (since 1900), *American Men of Science* (since 1906), *The American Naturalist* (since 1907) and *Leaders in Education* (since 1932-1944).

CATTERMOLE, George, English water color painter and book-illustrator: b. Dickleburgh, near Diss, Norfolk, Aug. 8, 1800; d. Clapham, Surrey, July 24, 1868. Like Joseph Mallord, William Turner and William Hunt, he started in life as a topographical draughtsman, and when only 16 years of age he was employed as a draughtsman upon John Britton's *Cathedral Antiquities of England* (14 vols., 1814-1835). In 1830 he visited Scotland to obtain materials for his fine series of illustrations to the *Waverley Novels* of Sir Walter Scott. Soon known as a brilliant illustrator, he was employed by publishers for the illustrations of various annuals. He illustrated the novels of Charles Dickens, an edition of Shakespeare and the *Historical Annual*, as well as his brother's *History of the Civil Wars*. As an artist he was distinguished by great versatility, and by considerable power of grouping and composition.

Rank	Year of census
1	December 31, 1945
2	January 1, 1946
3	September 1946
4	January 1946
5	July 1946
6	May 1946
7	Fall of 1946
8	March 1946
9	December 1946
10	August 1945

CATTLE.—The word cattle was at one time applied to many classes of livestock but its use today applies to animals of the bovine species. Cattle comes from the French word *catel* which is derived from Latin *capalle* or *capitale* meaning goods or property. The Biblical quotation (Psalms 50:10) "cattle of a thousand hills" undoubtedly referred to many classes of animals and Biblical commentators agree that cattle was associated with wealth.

The domesticated cattle, as we know them today, descended from wild forms that formerly lived in Europe and Asia. When and where cattle were first domesticated is unknown as it took place in prehistoric times. It is known, however, that man has been associated with cattle for many centuries. Naturalists have made extensive studies of bones found in ancient human dwelling places. Ancient and historical records, as well as works of art, depict the association of man with cattle. Fossil remains show that cattle existed in Europe before the glacial period but it has not been determined exactly whether our own domesticated cattle descended from this form or some other. Naturalists do not agree as to the classification of species but A. Keller, a German naturalist, states his conclusions to the effect that at one period there were two great races or breeds, namely, *Bos primigenius* and *Bos sondaicus* and attributes all of our modern breeds to either of these or to an admixture of both. The *Bos sondaicus* is believed to be the first type domesticated. This type may be described as having a broad, short head with short horns, which is characteristic of several European and English breeds such as the Shorthorn, Jersey and Guernsey.

The *Bos primigenius* may be described as a large powerful animal with long horns, long narrow head, which is typical of some present-day breeds such as the Holstein-Friesians. Selection, management, feed, climate, and other factors have been responsible for the development of the hundreds of breeds or strains of domesticated cattle scattered throughout the world. In England it is possible to see wild cattle in parks and on estates. They are known as the Chillingham cattle.

Another species known as *Bos indicus* is native to Asia and India. These cattle possess a hump over the shoulders and are called Brahman or Zebu. The term Brahman has been officially adopted as the correct name for descendants of these cattle in America.

There are really no cattle, as we know them today, native to America. The buffalo which roamed America before its discovery by the white man belongs to the same general class or same types of wild cattle that roamed Europe and Asia. All of the breeds in America have descended from cattle of Europe, Asia, and England.

Numbers and Distribution of Cattle.—According to statistics available in 1948 the 10 leading cattle-producing countries of the world were as follows:

Country	Number of cattle
India	200,000,000
United States	82,434,000
Brazil	42,000,000
USSR	41,500,000
Argentina	34,000,000
China	22,000,000
France	14,273,000
Australia	13,873,000
Colombia, S. A.	13,000,000
Union of So. Africa	13,000,000

According to estimates reported for 1947, the ten leading states of the United States in cattle numbers were:

Rank	State	Number of cattle	Value
1	Texas	8,754,000	\$609,278,000
2	Iowa	5,189,000	544,845,000
3	Wisconsin	3,962,000	586,376,000
4	Nebraska	3,882,000	354,815,000
5	Kansas	3,537,000	315,500,000
6	Minnesota	3,527,000	395,024,000
7	Illinois	3,303,000	376,112,000
8	Missouri	3,051,000	291,065,000
9	California	2,910,000	320,100,000
10	Oklahoma	2,724,000	195,038,000

Cattle along with some other animals such as the goat have cloven hooves and differ from the horse which has a solid hoof.

Cattle also differ from many other animals in that they have no front teeth on the upper mandible, their front teeth on the lower jaw meet with a membranous pad on the upper jaw when grazing on grass or other herbage. All cutting is done with lower teeth and grass is cut and pulled in the process of grazing.

The cow's stomach has four compartments, and she is classed as a ruminant. The compartments are known as the rumen, paunch, or first stomach; the reticulum, honeycomb, or second stomach; the omasum, manyplies, or third stomach; and the abomasum, or true or fourth stomach. Food eaten by the cow first enters the rumen, where it is stored for a time while being softened and somewhat mascerated. During repose the cow forces small quantities of the food back into her mouth and rechews it into a small ball or cud. After chewing or ruminating on each cud for a time she swallows it into the second stomach. The first three compartments are mainly for storing the food material, true digestion taking place in the fourth stomach and finally in the intestine.

Chemical, bacteriological, and other digestive processes take place during the course of the food through these compartments and the intestines and the resultant materials are taken up in the blood stream to produce muscular and bone tissue, body growth, and milk.

In general, the domestic cattle may be divided into classes or types, namely dairy, beef, and dual purpose. In reality all types are dual purpose since they all produce milk and the carcass is used for meat. The dairy type, however, has been developed for the prime purpose of producing milk. Selection has given the dairy cow a distinct type of body, being angular or wedge-shaped, with a long, thin neck and lean shoulders, large barrel, and large spacious udder. Beef type cattle have short necks, smooth wide shoulders, wide breasts, large heart girth; they are well muscled and smooth over the back and loins, and have heavy hind quarters.

The following breeds are represented by the cattle of the United States:

Dairy breeds	Beef breeds
Ayrshire	Shorthorn
Brown-Swiss	Polled Durham
Holstein-Friesian	Hereford
Guernsey	Aberdeen Angus
Jersey	Galloway
	Santa Gertrudis
Dual purpose	Minor breeds
Milking Shorthorns	Dutch Belted
Red Poll	Red Sindhi
	Red Danish
	Devon

Dairy Breeds.—The dairy breeds or strains of cattle originated from the same foundation

stock as the beef breeds or dual-purpose breed. During the past century, perhaps more progress has been made in the improvement of dairy cattle than in most other classes of livestock. As a result of intelligent and careful selection, aided by measurements of milk production, the improved dairy cow is now a highly efficient and profitable farm animal. The original cow gave only enough milk to rear her calf. Today some cows give enough milk in a year to raise 20 calves. Improvement of the dairy cow has lengthened her lactation period, from a few months to a year or more. The butterfat content of the milk of certain breeds has likewise been improved. The tendency to lay fat on the body has been eliminated to a great extent in the dairy cow, and her efficiency in the production of human food has been greatly increased as compared to the special purpose breeds.

The following table shows the comparative amount of dry matter in the carcass of a fat steer weighing 1,250 pounds and in the milk produced by a Holstein Friesian cow in one year.

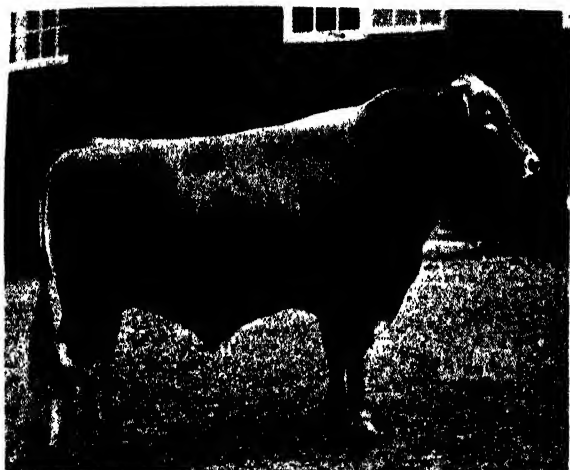
	Milk, 18,405 pounds	Steer, 1,250 pounds
Proteids	552 pounds	172 pounds
Fat	618 "	333 "
Sugar	920 "	" "
Ash	128 "	43 "
Total	2,218 pounds	548 pounds

The 2,218 pounds of dry matter from the year's production of the dairy cow was all edible and digestible, while the 548 pounds of dry matter produced from the carcass of the steer included the bones, hair, and all of the organs of digestion, respiration, and circulation. Individual cows of the several breeds have produced much more milk than the cow shown in the table. Some Holstein cows have produced more than twice as much milk in a year.

Ayrshire cattle originated in southwestern Scotland in the latter part of the 18th century, in the county or shire of Ayr. Little is known of the origin of this breed but it is certain that it resulted from crossing cattle of various breeds. The first importation into the United States was in 1822 and Ayrshires are now found in nearly every state in the Union. Many Ayrshires are also found in Canada and in northern Europe. In size the Ayrshire cow will average around 1,100 to 1,200 pounds and the bulls from 1,500 to 2,000 pounds. The color of this breed is usually red and white. Individual animals may be nearly all white or red, or show broken color of red and white. The cows are good milkers averaging to produce around 9,000 to 10,000 pounds of milk per year with an average butterfat content of 4 per cent. Several cows of this breed have produced more than 20,000 pounds of milk and 900 to 1,000 pounds of butterfat annually. The cows fatten readily when dry and make an acceptable quality of beef. Many farmers prefer Ayrshires because of their beef-making tendency. One of the particular characteristics of Ayrshires is their rather long horns, which curve upward and backward. A strain of polled Ayrshires (without horns) has been developed in the United States.

Brown-Swiss cattle originated in Switzerland and are classified as dual purpose there, or even as triple purpose cattle, since they are used for milk, meat, and work. The color ranges from a light gray to a dark gray or brown. The cattle have large frames, mature cows weighing about 1,100 to 1,500 pounds and mature bulls 1,500 to

CATTLE



Brown Swiss bull.



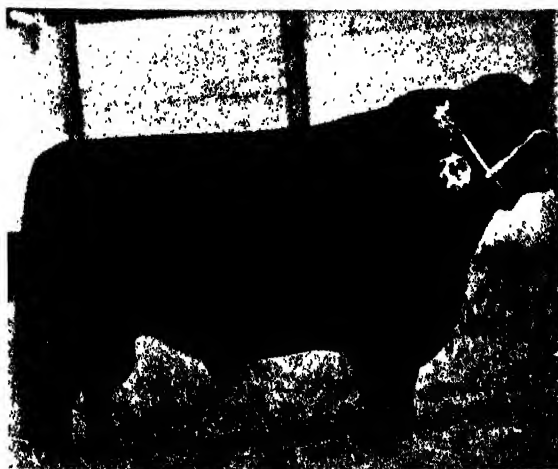
Brown Swiss cow.



Red Polled bull.



Red Polled cow.



Galloway bull.



Galloway cow.

Strohmeier & Carpenter

CATTLE



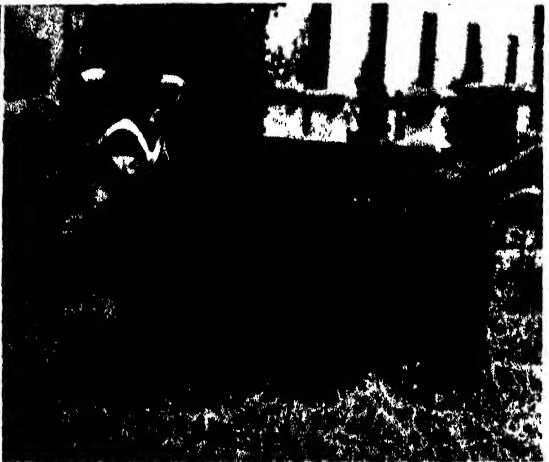
Hereford bull.



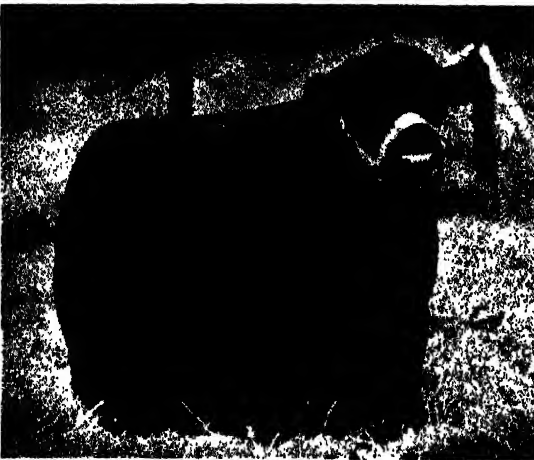
Hereford cow.



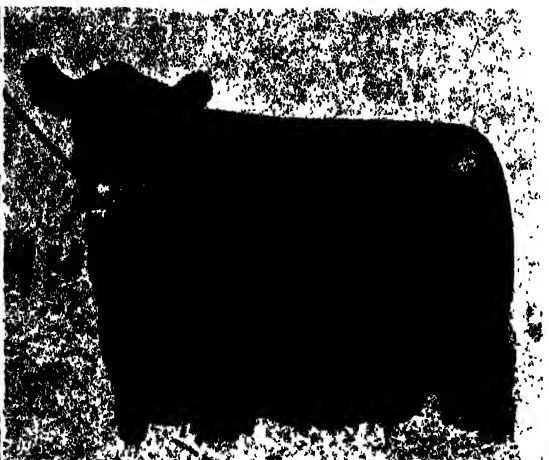
Shorthorn bull.



Shorthorn cow.



Angus bull.



Angus cow.

Strohmeier & Carpenter

2,300 pounds. The young calves at birth are solid white but as they grow older they change to the characteristic color for the breed. Representative cows of this breed will produce from 10,000 to 12,000 pounds of milk annually and it contains on the average about 4 per cent of butterfat. Several cows of the breed have made official records of over 22,000 pounds of milk and 1,000 pounds of butterfat per year. The first importation of Brown-Swiss cattle into America was made in 1869.

Holstein-Friesian cattle originated more than 2,000 years ago in western Europe, in the area now known as Holland or Netherlands. The first importation into America was in 1795. This is a horned breed and they are black and white in color. Some may be almost solid black and others almost solid white, but they are not acceptable to the breeders unless they have some white and black on the body, head, or legs. This is the largest breed of dairy cattle, and in their native country the animals are used for milk, meat, and work. Mature cows weigh from 1,200 to 1,800 pounds and mature bulls from 1,600 to 2,400 pounds. In milk production the cows of this breed exceed all other breeds. Mature cows will average to produce 10,000 to 15,000 pounds of milk annually, with a butterfat test of about 3.4 per cent. Many mature cows of the breed have produced more than 30,000 pounds of milk and 1,000 pounds of butterfat annually. Some have made yearly records of over 40,000 pounds of milk and more than 1,200 pounds of butterfat. The Holstein-Friesians are the most popular of all the dairy breeds as milk producers. It is estimated that nearly 70 per cent of all milk produced by dairy cattle in the United States comes from Holsteins. They are particularly popular for producing market milk near our large cities. Cattle of this breed are to be found in every state in the United States and are known and used in all countries.

The *Guernsey* breed originated on the island of Guernsey, one of the islands in the English Channel, where it has been kept pure for several centuries. In the early stage of the development of this breed, all cattle in the Channel Islands were known as Alderney cattle. Importation of cattle of any kind to Guernsey Island or to other islands in the group has been prohibited except for slaughter for many decades. Guernsey cattle resemble the Jersey in color, which may range from a reddish yellow to lemon or orange, with white markings. They are larger than the Jersey, have bigger bones, and are somewhat more rugged. Cows weigh 900 to 1,000 pounds and bulls weigh from 1,600 to 2,000 pounds when mature. One of the outstanding characteristics of this breed is the deep yellow color of the milk. The Guernsey Breed Association has been quite successful in popularizing the product of its breed under the name of Golden Guernsey milk. Mature cows of good breeding will average 8,000 to 10,000 pounds of milk, with an average butterfat content of 4.5 to 5 per cent. The number of registered Guernseys in the United States is second only to the Holstein-Friesians. The first importation into the United States was made in 1833.

Jersey cattle originated on the island of Jersey in the English Channel and the breed has been kept pure there for more than 100 years. Laws prohibiting importation of breeding cattle into the island have prevented any admixture of a

foreign breed. Earliest importations into the United States were made in 1850. The color is some shade of fawn ranging from a very light shade to almost black. White markings may appear on animals and are referred to as "broken color."

The females at maturity weigh from 800 to 1,000 pounds and some attain a greater weight; the mature bulls weigh from 1,200 to 2,000 pounds. This breed is noted for the production of milk rich in butterfat, excelling all other dairy breeds in this respect. Mature cows will produce from 6,000 to 10,000 pounds of milk, with an average butterfat test of about 5 per cent. Many cows of this breed have produced more than 18,000 pounds of milk and 1,000 pounds of butterfat in a year. The Jersey is highly prized as a family cow.

Beef Breeds.—The breeders of strictly beef cattle have made a tremendous improvement in the various breeds. This is borne out by photographic records showing the change that has taken place in the type of cattle shown at fairs 40 to 50 years ago as compared with the modern type. Noticeable changes resulting from selection and breeding are the shorter legs and earlier maturity of modern breeds.

It has been more difficult to make progress in the breeding of beef cattle than in breeding dairy cattle, in that no definite yardstick has been developed for measuring improvement in the individual animals as is possible with dairy cattle, where production records of milk and butterfat are the yardstick for measuring progress.

Attempts have been made to develop standards through feeding tests. In such tests records are kept of the gain in weight from birth to slaughter; records of all feed consumed during the same period, and a slaughter score based on dressing percentage and physical and chemical characteristics of the cooked meat are designed to be used to measure the difference between the individual animals from known parentage. Such tests will be invaluable as a means of selecting breeding stock to improve meat production. In some strains or families of certain beef breeds, the beef characteristics have been developed at the expense of the dairy or milk characteristics until the cows give very little milk; in many cases they do not give enough milk to nourish their calves properly.

Shorthorn cattle originated in England and first came into prominence during the latter part of the 18th century. They were imported into the United States as early as 1783. The color is red, red and white, white, or roan which is a mixture of red and white hair over the entire body. Mature cows weigh from 1,300 to 1,800 pounds and mature bulls weigh from 1,800 to 2,500 pounds. This breed is highly prized in the corn belt and they are economical producers of meat of high quality. The cows are usually good milkers as compared with other beef breeds. Shorthorn cattle are known all over the world and can be found in almost any country. The true Shorthorns are horned cattle.

Hereford cattle are native of England and were developed in Herefordshire in the western part of that country. They were first imported into the United States about 1820. Cattle of this breed are sought after by ranchmen because of their ability to rustle for their feed. They are large cattle, although smaller than the Shorthorn. The main portion of the body is red and the

face is white. Hence the term "white-faced cattle" as they are generally known. White markings are found on legs, on lower part of belly and brisket, and on top of neck. The cows usually weigh 1,300 to 1,500 pounds and the mature bulls from 1,500 to 2,300 pounds. One of the outstanding characteristics of the breed is early maturity. There are more cattle of this breed on the range country in the United States than of any other beef breed. This is generally known as a horned breed, but there are a considerable number of polled Herefords in the United States.

Aberdeen Angus cattle originated in Scotland. They are a hornless breed and are often referred to as polled Angus. The color is black, but occasionally a red animal may be born in a purebred herd. Red is undesirable from the purebred breeder's standpoint, however, and such animals are culled out. Angus cattle are very popular in the corn belt. Mature cows weigh from 1,200 to 1,500 pounds and bulls weigh from 1,600 to 2,000 pounds or more. Breeders often cross their Angus females with pure white Shorthorn bulls to produce blue-gray or blue-roan steers, which are highly prized by feeders. The quality of beef of the Angus is excellent.

Galloway is another breed which had its origin in Scotland. Typical cattle of this breed are low, blocky animals, with a long, soft, shaggy coat of black hair. The breed is hornless. Galloway cattle are adapted to cold climates and they are excellent rustlers for feed. They have not proved as popular as the other principal beef breeds.

The *Santa Gertrudis* breed had its origin in the United States. It is red in color and represents a cross of Brahman cattle with the Shorthorn. The Brahman cattle have certain characteristics that make them well adapted to warm climates in tropical and subtropical areas. The cross which has been pretty well established and will reproduce is a mixture of about five eighths Shorthorn blood and three eighths Brahman blood. Cows weigh 1,200 to 1,500 pounds and bulls weigh 2,000 pounds or more when mature. The color is red, they have a very deep body, good beef conformation, are very hardy and seem to be particularly adapted to southern range conditions. There has been a good demand for these cattle. They have the quality of heat resistance, are good rustlers and are not as susceptible to certain diseases as other cattle. Other crosses have been made with Brahmans and Herefords as well as with Aberdeen Angus.

Dual Purpose Cattle.—The *Milking Shorthorn* is perhaps the most popular dual-purpose breed known today. The origin of this breed is the same as that of the Beef Shorthorn breed. The dairy production is a result of selection and mating animals of heavy milk production. The color is red, red and white, and roan. These cattle are very popular in the general farming areas in the United States and in other countries. The cows usually weigh from 1,200 to 1,500 pounds. Some cows have made excellent milk records, giving more than 18,000 pounds per year; the average, however, produces from 6,000 to 8,000 pounds of milk with an average butterfat test of 3.5 to 4 per cent. The cows fatten readily when dry; the calves, being quite large at birth, are much more valuable for veal, or to feed out as steers, than the calves of the special dairy breeds.

Red Polled cattle, as signified by their name, are red in color and do not have horns. They originated from cattle that existed in Norfolk and Suffolk, England. They are much sought after as dual-purpose cattle. Some breeders emphasizing the dairy potentialities have produced cows with records of 20,000 pounds of milk per year. The average test for butterfat is about 4 per cent. Red Polled cattle are very popular in the corn belt, where the farmer desires to run a dairy and at the same time wants to use the steer calves to produce good meat animals. Cattle of this breed cross well with other breeds such as the Shorthorns. They transmit a red color and the polled character quite uniformly.

Minor Breeds.—There are several minor breeds of dairy cattle but they are of no great economic importance and there are relatively few in the United States.

Dexter Kerry cattle originated in Ireland, are black in color and small in size, even smaller than the Jersey, but they are not equal to the Jerseys as milk producers.

Devon cattle had their origin in Devonshire in England. They are a horned cattle and are red in color. Some breeders have specialized in developing the beef type and others have followed a dual-purpose type. There are only a very few of these cattle in America. In the early days the Devon oxen were highly prized as draft animals.

The *Dutch Belted* breed originated in Holland, where it is classified as a dairy breed. This breed was developed by selection from other types or breeds, very largely on the basis of color. The desired markings are solid black with a white stripe encircling the body between shoulder point and the hip. The greatest interest manifested in this breed since its origin has been by those who wanted something different. Only a few cattle of this breed ever left Holland. There are several hundred in the United States.

In Canada the *French Canadian* cattle are classified as a dairy breed. They are largely confined to Canadian farmers' herds, and are only fair producers of milk and butterfat.

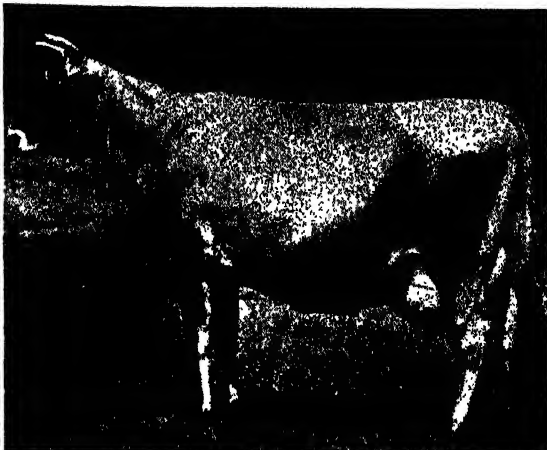
Red Sindhi cattle, which belong to the Brahman or Zebu type of cattle, are native to India and are rated as a dairy breed in that country. In 1946, four head (two males and two females) were imported by the United States Department of Agriculture for the purpose of developing a strain of dairy cattle for tropical and subtropical areas. This breed, in common with all Brahman cattle, has the ability to resist high temperatures and it is also more or less resistant to certain diseases and pests. The purpose in bringing these animals to America was to cross them with certain dairy breeds with the hope of capturing at least a part of their resistance to heat. Experiments in crossing the Red Sindhi with dairy breeds are being conducted at Jeanerette, La.

Red Danish cattle originated in Denmark and make up 95 per cent of the total number of cows kept for milk in that country. They were developed by crossing the native cattle of Denmark with other known breeds. They are of particular interest because the average production of milk and butterfat is higher per cow in Denmark than in any other country in the world. The first and only importation of Red Danish cattle into America was in 1935. They are held in great favor by those who have had experience with them. They might be classed as a dual-purpose

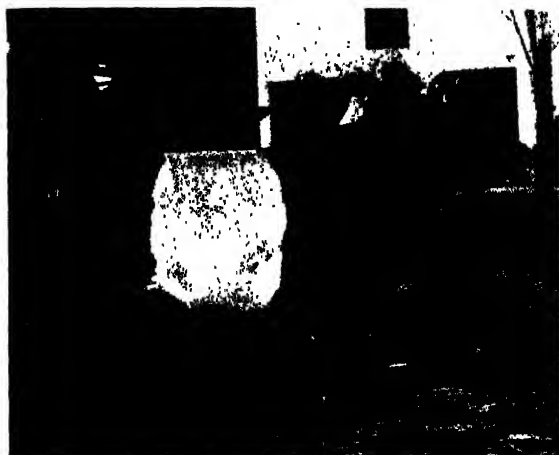
CATTLE



Jersey bull



Jersey cow.



Dutch belted bull.



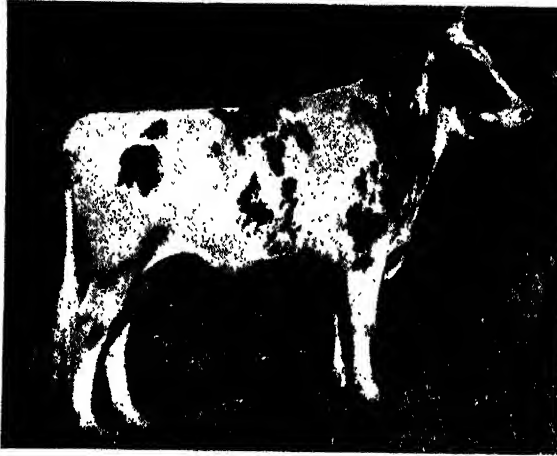
Dutch belted cow.



Dexter bull.

Dexter cow.

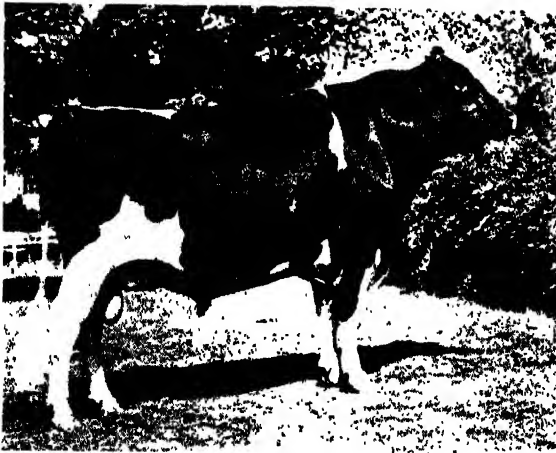
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Ayrshire bull.



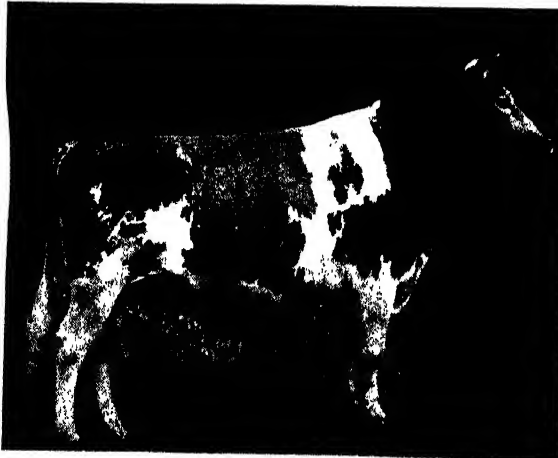
Ayrshire cow.



Holstein bull.



Holstein cow.



Guernsey bull.



Guernsey cow.

Strohmeyer & Carpenter

breed, with the greater emphasis being placed on their dairy qualities.

Herd Books.—It is customary in almost all countries, where distinct breeds are known to exist, to have a registration system or herd book in which records of birth and parentage of individuals are kept. Cattle registered in such herd books are often called purebred cattle, but they should be more appropriately called registered cattle. The various herd books were founded by the specific breed associations or societies and usually they are operated under their direction. In some countries, however, the government operates the herd books. In addition to keeping records, the breed associations publish educational and other informational booklets and pamphlets concerning the merits of their breed. The dairy breed associations in most countries also keep a separate record referred to as an advanced register or register of merit. The milk and butterfat records of individual cows and herds and other detailed information are published for the information of breeders.

In the United States, England, Denmark, and certain other countries, a system of keeping records of milk production and feed costs is encouraged by government agencies. In the United States, dairy farmers organized dairy-herd-improvement associations or cow-testing associations, with the help of federal and state extension services, for the purpose of keeping records on all cows on their farms. The first cow-testing association was organized in Denmark in 1895. The first one in the United States was organized in 1906. Information obtained by this cooperative effort serves as a guide to each herd owner in breeding, selection, and feeding of dairy cattle for more economical milk production. The effectiveness of such practices is evident in the fact that in 1947 nearly a million cows were enrolled in herd-improvement associations and their average yield was 8,638 pounds of milk and 348 pounds of butterfat per cow, as compared with an average of 5,000 pounds of milk and 199 pounds of butterfat for all other cows milked in the United States.

Proved Sires.—Cattle breeders have long appreciated the value of a sire that proved to have the ability to beget uniform and productive offspring. Dairymen have given more attention to the development of proved sires during the past 30 years than heretofore. The method of proving a dairy sire is to test his unselected progeny by keeping milk and butterfat records on each individual for at least one year and comparing such records with those of their dams when made under similar feeding and environmental condition. The sires whose daughters show an increase in production over the records of their dams are termed meritoriously proved sires and are much sought after by individual breeders as well as by the artificial-insemination associations. A requirement usually set up is to compare at least five unselected daughters with their five dams; however, it is much better to have a larger number for this comparison. Some 4 or 5 years is required to prove a bull, from the time he is ready for service until his daughters complete their first lactation period. Through the continuous use of good proved sires it is possible to develop a herd of dairy cattle in a few generations that will be nearly pure in their inheritance for high milk and butterfat production.

Crossbreeding.—During the past few years

considerable effort has been made to study the effect of controlled crossbreeding in both beef and dairy cattle. This practice in breeding other kinds of livestock and poultry, as well as with many plants has met with considerable success. As an example of the work of crossing dairy cattle the following data are from an experiment conducted at the Agricultural Research Center of the United States Department of Agriculture at Beltsville, Maryland.

Two and three breed combinations of Jersey, Guernsey, Holstein-Friesian, and Red Dane cattle were made. A two-breed cross resulted when a male of one of these breeds was mated to a female of another. Three-breed crosses were made by mating such two-breed females to a proved sire of a third breed.

The measure of producing ability was the amount of milk and butterfat produced when milked three times daily for 365 days in the first lactation period. Records completed thus far show the following average production:

	Number	Milk lbs.	Butterfat %	Age at calving lbs. Yrs. Mths.
Two-breed crosses	50	12,958	4.56	586 2 2
Three-breed crosses	27	13,130	4.64	618 2 2

Artificial Insemination.—One of the great developments now being used to improve cattle, particularly dairy cattle, is the artificial-breeding organization. The USSR and Denmark have been leaders in this new method of improvement. In 1948 artificial insemination with dairy cattle was followed in many countries.

Through artificial insemination it is possible to breed 10 to 100 times as many cows to one bull as with natural service. There are many advantages in the use of this method. One big advantage is that it is not necessary to keep a bull on every farm. Another is that semen is usually available from a better-bred sire than would otherwise be the case, especially for small herds. Proved sires are very much in demand for use in artificial-breeding associations. Farmers organize artificial-breeding associations, establish a central unit of good bulls, and then employ technicians to handle the program. During the year 1947, 1,700,000 dairy cows were bred artificially in the United States. The average service for each sire used was about 500 cows. This plan, if properly managed and operated, offers the greatest method yet devised for mass improvement in dairy cattle.

Cattle Feeding.—Cattle subsist largely on pasture grasses and other roughages, either in the fresh green state or cured as hay—many crops such as the legume hay crops, corn, soybeans, and sorghums are stored in a silo as roughage feeds. In the feeding of a herd of either beef or dairy cattle they should have access to all the good roughage (pasture, hays, silage, etc.) that they can consume and an additional amount of concentrates (grain) to make up the total nutrients required for growth or milk and meat production. Definite standards for feeding cattle, young or old, beef or dairy, have been worked out on an accurate basis and are available in texts and references given at the end of this article.

In general, dairy cattle will make a greater return on high-priced land than will beef cattle. Beef-cattle herds are more adapted to the ranges where feed can be more economically produced. See also CATTLE, DISEASES OF.

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O. E. REED,

Chief, Bureau of Dairy Industry, United States Department of Agriculture.

CATTLE, Diseases of. Since the cow is the foster mother of the human race, diseases of cattle are second in importance only to those of man himself. It is significant that only those nations which control and prevent diseases of their cattle and other livestock are well fed.

INFECTIOUS DISEASES

Many serious and destructive diseases of cattle are caused by infectious agents, such as viruses, bacteria, protozoa.

Foot-and-Mouth Disease.—Because of its extreme infectiousness, its rapid spread, and its devastating effects, foot-and-mouth disease is one of the most feared of all the maladies attacking livestock. It strikes both domestic and wild cloven-footed animals, such as cattle, sheep, goats, swine, camels, deer, buffaloes, antelope, and giraffes.

For decades this disease has been well established in most areas of the Old World. It is now found also in most of the principal cattle-producing countries of South America. Until it appeared in Mexico during 1946, North America had been free of it except for 10 outbreaks, none of which had become firmly established. Eight of these involved the United States only, one included both the United States and Canada, one was restricted to Mexico. The most widespread of these occurred in the United States during 1914-1915. It invaded 22 states and the District of Columbia. The 1946 invasion of Mexico appeared first in the state of Vera Cruz and soon spread into 17 states and the Federal District, a territory containing approximately 15 million cloven-footed animals.

Australia, New Zealand, the Union of South Africa, Colombia, Canada, the United States, and Ireland are free of foot-and-mouth disease.

Cause.—The cause of this disease is a virus, much too small to be seen with the usual high-power microscope. This virus lives and multiplies in the tissues of affected animals, especially the membranes of the mouth and tongue, the skin between the hoofs, and the lining of the first stomach. It is present in the blood, milk, saliva,

urine, flesh, and bones of infected animals. There are at least three types of virus: recovery from an attack by one of these does not protect against either of the others.

Method of Spread.—The most common method of spread is through contact of susceptible animals with infected animals or animal products. But it may be transmitted by such factors as infected hay or straw, persons who have come in contact with the virus, infected premises or railroad cars. The incubation period is very short; symptoms usually appear within three to seven days after exposure.

Symptoms.—As the name indicates, the mouth and the feet are usually affected. Blisters or vesicles form on the tongue, in the lining of the mouth and lips, between the toes, and around the top of the hoofs. These blisters soon rupture and leave reddened, shallow ulcers. Affected animals eat very little, have fever, lose weight rapidly. If the feet are affected, lameness may be very severe. Cattle with the disease may drool with ropy saliva hanging from the lips. Cows in milk show a rapid and marked decrease of milk production and pregnant cows may abort.

Mortality is high among very young calves and old, heavy bulls. Most mature animals in good condition recover, but the convalescent period is rather long, because lameness persists after the active stage of the disease has passed, and the ulcers in the mouth require time to heal.

Diagnosis.—In typical outbreaks the rapid spread of the disease, its ability to attack all types of cloven-footed animals, and the severity of the symptoms help in making a definite diagnosis. But it may be necessary to make experimental inoculations and laboratory tests, as two other diseases also cause similar formation of vesicles.

Treatment.—No satisfactory treatment has been found.

Control and Eradication.—Foot-and-mouth disease is so infectious that quarantine alone usually fails to prevent its spread. During the 1940's the use of a new vaccine combined with quarantine became rather general. Although the vaccine gives rather good protection, its effect is not permanent. Consequently it is necessary to revaccinate at frequent intervals to insure continued resistance. Furthermore a vaccine made with one type of virus will not protect against either of the other two. In most areas where vaccination and quarantine measures have been combined, the prevalence of the disease has been reduced considerably and losses have decreased markedly. But attempts at complete eradication through vaccination and quarantine alone have been unsuccessful.

On the other hand, slaughter of affected and exposed susceptible animals, strict quarantine, and thorough cleaning and disinfection of infected premises have been repeatedly successful. Outbreaks in the United States since the federal Bureau of Animal Industry was organized (1884) have been exterminated by these procedures. Other countries have used them with equal success. The United States is firmly committed to this method of handling outbreaks.

A combination of these measures and vaccination has been used in Switzerland and since 1946 is being applied in Mexico. In the latter country quarantine lines demarcate the infected area from the disease-free areas. Attempts to inspect every cloven-footed animal within the infected zone at

30-day intervals are made. Every animal found to have foot-and-mouth disease and any unvaccinated, exposed, susceptible animal is destroyed and buried. Infected premises are cleaned, disinfected, and quarantined until they are proved by tests to be free of infection. All cloven-footed animals within the quarantined area of Mexico are vaccinated every four months.

During the last six months of 1949 foot-and-mouth disease was found on less than a dozen premises in Mexico. In that period more than 20 million doses of vaccine were used.

Prevention.—Obviously it is very expensive to try to protect a country from foot-and-mouth disease through vaccination. But the United States, Canada, Australia, and New Zealand have proved that the disease can be excluded for long periods of time by strict quarantine, combined with constant watchfulness and vigorous extirpatory measures, if the disease does appear.

Economics.—A livestock-producing country would find it advisable to spend comparatively large sums of money for preventive measures rather than to have foot-and-mouth disease become firmly established in it. The outbreak in Germany during 1911 is said to have attacked more than 14 per cent of its approximately 50 million cloven-footed animals in spite of governmental attempts to control it. Switzerland, with a livestock population about one fiftieth of that of the United States, is reported to have lost about 70 million dollars from the outbreak in 1920-1921. An invasion of similar severity in the United States would cost this country over 3.5 billion dollars.

Rinderpest.—This acute, infectious disease attacks cattle, sheep, goats, and buffaloes. It occurs in Asia and in Africa and has invaded Europe occasionally.

Cause.—The cause is a virus too small to be seen with a high-power microscope. So far as is known, this virus does not multiply outside the body of a susceptible animal. It is present in the tissues, blood, urine, and evacuations of infected animals. It spreads from animal to animal by direct contact or by such intermediate carriers as infected hay, implements, and utensils, persons with the virus on their shoes or clothing, and infected premises.

Symptoms.—Affected animals develop severe symptoms rather quickly. They have high fever, rapid loss of weight and marked debility. Diarrhea is a very common symptom. The dung may be streaked with blood, especially in the later stages of the disease. Coughing with a discharge from the nose is common. Fully susceptible cattle usually die in 4 to 10 days after attack.

Treatment.—As in most acute infectious diseases, no satisfactory treatment is known.

Control and Eradication.—Vaccines which produce satisfactory immunity against rinderpest have been developed and tested on a rather large scale under field conditions. When widely used and combined with quarantine, they effect control of spread and very marked decrease in losses. But unless there is excellent enforcement of quarantine and vaccination regulations, the disease may smolder for months, only to recur when unvaccinated calves are raised. In countries where the disease recently has been introduced and consequently is not widespread, slaughter of infected and exposed animals, together with quarantine measures, has been successful in eradicating it completely.

Prevention.—Countries free of rinderpest, like the United States, maintain quarantines against infected areas.

Contagious Pleuropneumonia.—During the 19th century this very destructive disease of cattle caused serious losses in most of the countries of Europe, Asia, and Africa. It has invaded the United States several times, the first probably being in 1843.

Cause.—The organism causing contagious pleuropneumonia, *Asterococcus mycoides*, is smaller than most bacteria but larger than typical viruses. This agent lives in the lungs and other tissues of infected cattle. It usually spreads by direct contact between infected and susceptible animals, but can be transmitted indirectly through such media as infected barns, premises, railroad cars.

Symptoms.—As the name implies, this disease attacks the lungs and the pleura which covers them. In acute cases symptoms develop suddenly with rapid breathing, coughing, high temperatures, loss of weight. Animals so affected usually die in one to three weeks. In chronic cases symptoms develop more slowly. The coughing, scarcely noticeable at first, becomes pronounced, breathing is rapid and labored, the appetite decreases, and there is constant loss of weight. In the later stages, when most of the lung tissue is affected, the animals stand most of the time. When some chronic cases have only mild symptoms, recovery soon follows. Recovered animals may be carriers of the disease for a long time after symptoms have disappeared. In some herds nearly all the cattle contract the disease soon after its introduction, whereas in others it spreads slowly and many animals escape.

Treatment.—No satisfactory method of treatment exists.

Control and Eradication.—Many countries have eliminated this disease since 1860. Successful measures of eradication include slaughter of all infected and exposed cattle, strict quarantine of infected premises until they are thoroughly cleaned and disinfected, and periodic inspection to detect new centers of infection. Although these measures may seem severe and expensive, they are much preferable to living with the disease. By following them the United States and many other countries have eradicated contagious pleuropneumonia. No case has been found in the United States since 1892.

Prevention.—Strict quarantine prevents entry of this disease into countries which are free of it.

Tuberculosis.—Long a scourge of the cattleman and the dairyman, it is found in practically every part of the world where there is a considerable population of cattle. In countries having a heavy concentration of dairy cattle, the disease is usually prevalent and affects 10 to 40 per cent of the cattle.

Cause.—The cause is the bovine type of the tuberculosis organism, *Mycobacterium tuberculosis bovinus*. This germ may produce tuberculosis in many other species of animals, including man. As far as is known, under natural conditions it does not multiply outside an animal's body. However, it will live for many months in barns, stables, or yards, if it is protected from direct sunlight. These germs may escape from infected cattle in the dung, the urine, the milk, and the saliva. Infection may gain entrance into susceptible cattle from contaminated feed, milk, or water, by inhalation of infected materials, or through cuts or abrasions of the skin.

Symptoms.—It cannot be stressed too strongly that many cattle with generalized tuberculosis are in good physical condition and appear healthy. However, such animals may be active spreaders of disease.

Since tuberculosis is a chronic disease, symptoms usually develop slowly. Their character varies according to the organs affected. Thus cattle with tuberculosis of the liver and intestines may develop a persistent diarrhea, whereas those with affected lungs usually have a chronic cough. If the udder is attacked, the affected quarters may enlarge and become firm without being hot and painful. As the disease progresses, most affected cattle develop a rough coat, become unthrifty, and lose weight. Most animals which develop symptoms finally die of the disease.

Diagnosis.—Tuberculin is used widely as a diagnostic agent, since thousands of critical experiments have proved that it is very accurate. It is made by growing tuberculosis organisms on artificial culture media, destroying the germs by heat, and filtering out the dead organisms. It never can cause tuberculosis, because it never contains living organisms.

Of the three tests with tuberculin, the intradermic test is most widely used by veterinarians. It is made by injecting tuberculin into the skin and observing the point of injection 72 to 120 hours later. Reactors develop a characteristic swelling at the injected spot. The subcutaneous test is made by injecting tuberculin underneath the skin. Tuberculous animals show a rise in temperature after injection. Since the temperature of each tested animal must be taken six to 10 times, the subcutaneous test is much more time-consuming than the intradermic test. The ophthalmic, or eye, test is not in general use, because most veterinarians who have tried it extensively believe it inferior to the intradermic test.

Treatment.—No satisfactory treatment for tuberculous cattle has been discovered.

Control and Eradication.—The experience of the United States and several other countries has proved that bovine tuberculosis can be controlled and eradicated. The successful method consists in locating the infected cattle by applying the tuberculin test, slaughtering them, cleaning and disinfecting the premises, and retesting until no reactors are found.

Officials of the federal Bureau of Animal Industry and state veterinary officials launched in 1917 a cooperative campaign to exterminate tuberculosis. For the first few years efforts were confined mainly to individual herds, but the program was changed gradually to area testing. A method of accrediting counties as being modified tuberculosis-free, when infection had been reduced to less than 1.5 per cent, was developed. When this program began, it was estimated that from 8 to 10 per cent of all dairy cows and from 1 to 2 per cent of all beef cows in the United States were tuberculous. In 1922, 4.2 per cent of all tested cattle reacted. In 1936, only 0.5 per cent of the tested cattle were reactors and by Nov. 1, 1940, every county in the country had attained the modified tuberculosis-free status. Only 0.19 per cent of the approximately 8 million cattle tested in 1949 were reactors.

In the United States untested cattle are not allowed to be moved in interstate commerce, except for immediate slaughter, unless they originate from accredited herds or modified accredited areas. Strictly enforced regulations require that

all imported cattle be accompanied by satisfactory official records showing that they are free of tuberculosis.

Bang's Disease.—This is, without doubt, one of the most serious infectious diseases of livestock, because it causes heavy economic losses to producers and it is transmissible to human beings. In the United States cattle and swine are most frequently attacked by the disease, but horses, sheep, goats, and other animals are susceptible. It occurs in all parts of the world where there is a well-developed livestock industry.

Cause.—The cause is a bacterial organism of the *Brucella* genus. There are three species: *Brucella abortus* in cattle, *B. suis* in swine, *B. melitensis* in goats. Cattle are susceptible to all three species, but only *B. abortus* causes typical symptoms and spreads from cow to cow. Hogs, too, may harbor all species, but *B. suis* is the only one of economic importance to the swine industry. Any of the three species may attack man, causing Brucellosis, an acute chronic disease also called undulant or Malta fever.

Brucella organisms may occur in almost any organ or tissue of an infected cow or heifer, but they are found most frequently in the udder and the uterus. They escape in large numbers from the infected uterus at the time of abortion or birth of the calf. Milk from infected cattle may contain these organisms. Bulls may harbor *Brucella* organisms in their testicles.

Method of Spread.—Susceptible animals become infected by eating contaminated feed, drinking contaminated milk or water, or having the germs come in contact with the skin. Human beings rarely or never contract the disease from infected persons. Contact with infected animals or animal products is the most potent source of human infection, but the use of infected foods, such as unpasteurized milk or cream from infected cows, may also produce the disease.

Symptoms.—In cattle the most characteristic symptom is abortion or premature birth. Shy breeding or sterility, mastitis or inflammation of the udder, decreased milk production, enlarged joints with or without lameness are other symptoms. But live calves are born to many infected cows and abortions occur among cows free of this disease. Consequently it is impossible to diagnose brucellosis accurately from symptoms alone.

Diagnosis.—The agglutination test made with blood serum is the routine method of diagnosing the disease.

Treatment.—No successful method of treating infected domestic animals has been found.

Losses.—This disease costs the dairy and beef industries of the United States at least from 50 to 100 million dollars annually. Infected cows, on the average, produce from 10 to 30 per cent less milk, have fewer live calves, and have more difficulty in breeding than noninfected cows.

Control and Eradication.—A national program of control and eradication, with federal and state veterinary officials cooperating, has been under way in the United States since 1934. In 1949 more than half a million herds containing nearly 6 million cows and heifers, or about 12 per cent of all female cattle of testing age, were tested. Slightly less than 4 per cent of them reacted. The percentage of reacting animals found is decreasing each year. Since this program began, thousands of herds have been freed of brucellosis by sending the reactors to the butcher.

cleaning and disinfecting the premises, and retesting at frequent intervals until no reactors are found. This procedure has been most successful in herds whose owners raise their replacements. Those who buy replacements usually reintroduce the disease sooner or later.

Vaccination against brucellosis has been widespread since Strain 19 *Brucella* vaccine became available. Since it has no curative value, this vaccine is recommended for use in brucellosis-free cattle only. Vaccinated cattle become positive reactors to the agglutination test. Heifers vaccinated at eight months of age or less usually lose their reactions after a few months, but vaccinated older heifers or cows may remain reactors for life. For this reason veterinarians do not usually recommend the use of vaccine in female cattle more than eight months old. Vaccinated heifers and cows ordinarily develop a marked, but not complete, resistance against the disease. Good results have followed vaccination of heifers in most herds wherein rigid sanitary precautions have been taken. But many owners apparently think vaccinates are completely protected and allow them to be severely exposed. Under such conditions a considerable number of vaccinates may contract brucellosis.

Prevention.—Since brucellosis is an infectious disease, a herd, a county, a state, or a country which is free of it can remain free by preventing the introduction of infection. This can be and is being done by the enforcement of quarantines. In areas where the disease is prevalent many owners of brucellosis-free herds vaccinate their heifers as an added precaution.

Anthrax.—One of the oldest diseases described in history, anthrax always has been one of the scourges of the livestock industry. Except for poultry, practically all farm animals as well as man are susceptible to this malady, but it affects most often cattle, sheep, horses, and goats. Swine also are sometimes affected. The disease is very widespread, occurring on every continent and in nearly every country.

Cause.—The cause of anthrax is a specific germ, *Bacillus anthracis*. This organism occurs in almost all tissues and organs of animals dying of the disease. Soil and pastures are contaminated by blood, dung, urine, and discharges from the nostrils and mouth of anthrax-infected animals. These germs form spores which, because of their resistance to drying, heat, and light, can live for years in the soil. Consequently, once infected, a pasture or a range may remain a constant source of danger indefinitely.

Domestic animals become infected by contact with diseased animals, grazing infected pastures, using infected pens or barns, eating infected feed, or drinking infected water. People contract anthrax by handling animals with the disease, especially by autopsying or skinning animals dead of anthrax, and by coming in contact with infected animal products, such as wool.

Symptoms.—The very acute form of the disease may kill cattle so quickly that almost no symptoms are seen. Acute cases live from a few hours to a few days and during this time have high fever, complete loss of appetite, marked depression, bloody diarrhea, and labored breathing. A foamy, blood-tinged discharge from the nostrils may appear shortly before death. The death rate among infected cattle is very high, but recoveries occur occasionally.

Diagnosis.—A positive diagnosis can be made

through finding anthrax organisms by a laboratory examination. Only veterinarians should hold autopsies and collect specimens from suspect cases, because of the great danger of untrained persons becoming infected from such practices.

Treatment.—If a very early diagnosis is made, the immediate use of large doses of antiserum may lead to recovery. Veterinarians report that some of the new antibiotics give good results. Any treatment must be used soon after symptoms appear.

Control and Prevention.—Vaccination produces marked resistance, but not complete immunity, against anthrax. All susceptible animals kept on known infected farms or ranches should be vaccinated before the anthrax season. If the disease appears despite vaccination, the animals should be shifted immediately to another range or pasture.

Since the carcass of an anthrax-infected animal is the most important source of infection, every such carcass should be completely burned without being opened. Any soil contaminated by discharges from sick or dead animals should be scraped up and thrown into a hot fire.

Farmers and ranchers whose premises are free of anthrax should never place on them grazing animals from infected pastures or ranges.

Blackleg.—This is an acute infectious disease occurring in nearly every cattle-producing country of the world. It affects young cattle principally; those less than from three to four months of age and more than two years old are seldom attacked. Well-bred cattle in good condition seem much more susceptible than common cattle, especially if the latter are not thrifty.

Cause.—The cause is *Clostridium chauvoei*, a very resistant organism which can live for many years in the soil.

Symptoms.—A hot painful swelling of the muscles of a fore or hind leg is usually the first symptom noticed. It crackles when rubbed, owing to the formation of gas under the skin. Severe lameness in the affected leg, loss of appetite, high temperature, and depression are other symptoms. Death usually occurs from 12 to 48 hours after appearance of symptoms.

Diagnosis.—Experienced veterinarians usually have little trouble in diagnosing blackleg. At autopsy they find that the muscles of the affected area are very dark and contain gas bubbles. A sweetish, disagreeable odor is said to be characteristic.

Control and Prevention.—No method of destroying blackleg germs in soil is available. Consequently, if young cattle are to be pastured on infected areas, owners must rely on vaccination, which has been found to be a reliable preventive. Calves should be vaccinated before the susceptible age, if they are to graze infected areas. Veterinarians recommend a second vaccination about a year later, if the soil of pastures is severely contaminated.

Seeding pastures with blackleg germs should be prevented by burning the carcasses of all cattle dying of the disease.

Piroplasmosis (Tick Fever).—In most of the tropical and subtropical countries of the world occurs this disease, which has attracted widespread attention, both because of its destructive nature and because it is the first disease proved to be spread by a parasite.

Cause.—Two species of parasites which attack the red blood cells of cattle, *Babesia bigemina*

and *B. argentina*, may cause tick fever. The natural method of spread from animal to animal is through tick bites. In the United States the common fever tick is *Boophilus annulatus*. Although this tick may attack other animals, such as horses or mules, it does not transmit this disease to them.

The life cycle of this tick is briefly as follows: Blood-engorged females drop off the host and lay eggs; eggs hatch into larvae; larvae attach themselves to cattle or other hosts and suck blood; after several days they molt and change to nymphs; nymphs suck blood, molt, and change to sexually mature ticks; mating occurs, after which the females engorge with blood and develop eggs; they drop off, thereby completing the life cycle. If a female has developed on an animal infected with tick fever, the larvae hatching from her eggs will transmit the disease to susceptible cattle.

Symptoms.—Young cattle are resistant to tick fever, but they gradually become susceptible as they grow older. Mature cattle develop symptoms suddenly from the seventh to the 14th day after infestation with disease-carrying ticks. They stop eating, become listless, develop fever, breathe rapidly, and lose weight. Milking cows have a marked decrease in production. Jaundice (yellow discoloration of the white of the eyes and of white skin) may occur. Dark-colored urine is a characteristic symptom which appears late in an attack. The disease runs a rapid course. The death rate is from 50 to 90 per cent in mature cattle. Symptoms are less severe and the recovery rate is much higher in cattle from 6 to 15 months old. Young calves develop few or no symptoms after exposure. Apparently recovered cases usually remain carriers throughout life.

Diagnosis.—Since some other diseases resemble tick fever, diagnosis is sometimes very difficult. The finding of fever ticks on sick or dead animals and the identification of the blood parasite by microscopic examination are the sheet anchors on which veterinarians depend.

Treatment.—Several drugs have given reasonably good results when used as treatments. Some of them are applied rather generally in areas where there is little prospect of destroying the disease. But veterinarians and cattlemen realize that eradication is by far the better procedure.

Eradication.—The disease can be eradicated by exterminating fever ticks. The U.S. Bureau of Animal Industry, in cooperation with the state livestock sanitary officials, began a program of eradication in 1906. Even before that, some 20 counties in North Carolina had been freed of the disease by extirpating fever ticks. The approved program consisted in dipping all cattle, horses, and mules in some tickicide, such as arsenic solution, at approximately two-week intervals. This prevents any female ticks from maturing and laying eggs. Dipping was continued until trained veterinarians and technicians no longer could find fever ticks.

Anaplasmosis.—This infectious disease of cattle often has been confused with tick fever. It occurs in most of the cattle-producing areas in tropical and subtropical regions and extends far into the temperate zones of some countries.

Cause.—The causative agent is *Anaplasma marginale*, a parasite of the red blood cells of cattle. Several species of ticks, including fever ticks, may act as carriers. Just as in tick fever, the offspring of female ticks developed on in-

fected cattle can transmit the disease. Other biting parasites, such as horseflies, may carry anaplasmosis.

Symptoms.—Symptoms in mature cattle include fever, fast pulse, rapid breathing, loss of appetite, rapid loss of weight. Marked jaundice is a prominent and usual symptom. Some affected animals are nervous and inclined to fight. The urine is usually normal in color. In the last stages sick cattle may be very anemic. From 20 to 60 per cent of affected mature cattle may die in from one to five days after symptoms appear. Animals which recover regain condition slowly. The yellow color of eyes and skin is noticeable for weeks after the acute attack has passed.

Symptoms are less acute and marked in yearlings and are scarcely noticeable in sucking calves.

Recovered animals usually remain carriers throughout their lives.

Diagnosis.—Veterinarians depend on the symptoms, findings at autopsy, and laboratory examination of blood for a definite diagnosis of the acute disease. No satisfactory method of detecting recovered cases which are carriers exists.

Treatment.—No very satisfactory treatment is known.

Control and Prevention.—Control and eradication is very difficult. Veterinarians neither can locate and remove the carrier cattle, as they do in eradicating tuberculosis, nor can exterminate the parasites which transmit the disease, as they do in extirpating tick fever. Great care should be exercised in dehorning, castrating, and bleeding cattle in known infected herds or areas, since anaplasmosis may be spread through carelessness in performing any of these operations. Owners of anaplasmosis-free herds should not add to them any cattle coming from infected herds or even from the vicinities in which such herds are found.

Nagana (Tsetse Fly Disease).—This infectious malady has prevented the development of any considerable cattle industry in a large part of central Africa. It is not known to occur in any other part of the world. The disease is caused by a blood parasite, *Trypanosoma brucei*, which is transmitted from infected to disease-free cattle by the tsetse.

Surra.—A blood parasite, *Trypanosoma evansi*, causes this infectious disease of cattle. It occurs in the tropical countries of Asia and the Philippines.

Countries free of this disease maintain quarantines to prevent its entrance. The necessity of such quarantines is proved by the fact that surra once was found in several cattle of a shipment held at quarantine in New York harbor for importation into the United States.

PARASITIC DISEASES

A large variety of parasites, including insects, worms, and protozoa, attack cattle.

Flies.—Four species of flies are found to spread disease among cattle.

Stableflies (*Stomoxys calcitrans*).—These important blood-sucking parasites of cattle closely resemble houseflies. They breed in manure or decomposing vegetable matter, such as straw. They can be controlled successfully by judicious use of DDT or some of the other new insecticides.

Horn Flies (*Haematobium irritans*).—In most sections of the United States these small blood-sucking flies are serious pests. Enormous swarms

may attack cattle, if conditions are favorable for their development. They breed primarily in cow manure. Some of the newer insecticides, such as DDT, are very effective against these parasites.

Screwworm Flies (*Cochliomyia americana*).—These serious parasites of domestic animals flourish in tropical and subtropical areas. They are destroyed by the winter cold of the cooler temperate zone so that, even when they invade such areas, they do not become permanently established.

The mature female fly lays eggs on or near wounds or bloody areas. These hatch into larvae or screwworms, which develop in the flesh. They produce serious injury, kill many untreated animals, and are especially destructive to newborn calves, lambs, and pigs.

Fly repellents, such as Smear 62, which was developed by the federal Bureau of Entomology and Plant Quarantine, are rather effective in preventing infestation of screwworms. If the worms are present, they all should be removed and the repellent should be applied to prevent further infestation.

Warble Flies (*Hypoderma lineatum* and *H. bovis*).—These are of considerable economic importance because of the damage done to both meat and leather. Mature female warble flies attach their eggs to hairs. When these hatch, the young larvae burrow through the skin, migrate through the animal's body, and finally become located under the skin of the back. After several weeks of development they emerge, drop to the ground, where they pupate. Here they undergo further development and finally emerge as mature flies.

The larvae may be killed by spraying, washing, or dipping infested cattle in rotenone solution. Warble flies can be eradicated, if all cattle in an area are treated so that no larvae mature.

Lice.—Three species of lice are rather commonly found on cattle in the United States. Two of these are bloodsuckers and may do serious harm. Many insecticides are fairly effective against these parasites, if they are properly used as dips or sprays.

Mange, Itch, or Scab Mites.—Four species of mites occur on cattle in the United States causing mange, itch, or scab. The part of the skin affected varies according to the species of mite present. If neglected and left untreated, scab may spread through a herd, affecting most of the cattle and causing serious damage.

Symptoms, diagnosis, treatment:—Symptoms are scratching, shedding of hair, thickening of skin. Definite diagnoses are made by finding the mites. Solutions containing lime-sulphur, nicotine, benzene hexachloride, or crude petroleum are used successfully in treating infested cattle.

Ticks.—Nearly a dozen species of ticks have been reported as parasites of cattle in the United States. Since all these are bloodsuckers, they do serious harm if present in considerable numbers. The tickicides (see TICK FEVER) will destroy most of these species, but unfortunately many of them have life cycles unfavorable to eradication.

Worms.—In cattle these are distinguished by the organs which they invade.

Roundworms of Stomach and Intestines.—These include at least three rather common stomach worms (*Haemonchus contortus* or the twisted wire worm, *H. similis*, *Ostertagia ostertagi*) and half a dozen or more intestinal worms (*Bunostomum phlebotomum* or the cattle hookworm, at

least three cooperids or hair worms, *Neoascaris vitulorum* or the large roundworm, *Oesophagostomum radiatum* or the nodular worm). In nearly every case of parasitism occurring under natural conditions, more than one of these species are present. Most of these parasites have somewhat similar life cycles. Mature females lay eggs which are evacuated with the droppings and which then hatch. The larvae must molt before they become infective. Following molting, which requires only a few days, they encyst on grass or other vegetation and develop into mature worms, if swallowed by a susceptible animal.

Symptoms: Weanling calves and yearlings are most often attacked; mature cattle, only occasionally. Symptoms include unthriftiness, failure to grow and to gain weight, loss of weight, rough hair coat, chronic diarrhea, bottle jaw (a soft painless swelling in the throat region). Veterinarians make a definite diagnosis by holding an autopsy or by finding worm eggs in the droppings through a microscopic examination.

Treatment: Phenothiazine is very effective as a treatment against many of these parasites. Other drugs, such as tetrachlorethylene, have been used.

Control: Fortunately, cattle infested with small numbers of stomach and intestinal worms usually develop a fairly effective resistance against further infestation. Control measures include rotation of pastures, allowing them to be idle, and avoidance of overgrazing.

Lungworms (*Dictyocaulus viviparus*).—These parasites, which cause husk or lungworm disease, live in the trachea and bronchial tubes. Their life history is similar to that of the roundworms of the stomach and intestines, but their larvae are destroyed more easily by drying. Consequently they are not serious parasites, if the pastures or ranges are dry.

Symptoms: These are seen most often in calves and yearlings. They include coughing, rapid breathing, unthriftiness, failure to gain properly.

Treatment: No successful medicinal treatment has been found.

Control: Since the larvae are short-lived, a rest period from six weeks to three months will usually free a pasture of infestation.

Liver Flukes (*Fasciola hepatica*).—The most serious of the flatworms infesting cattle, these parasites are shaped somewhat like a cherry leaf and in the mature form are nearly an inch long. They live in the bile ducts and gall bladder and pass their eggs into the intestines along with the bile. After leaving the body in the dung, eggs hatch if they are moist and warm. The larvae attack certain species of snails, burrow into them, and undergo further development and multiplication. Finally they emerge from the snail and encyst on grass or even on the surface of the water. When these cysts are swallowed by cattle, the young parasite burrows through the wall of the intestine and enters the liver.

Symptoms:—Flukes attack cattle of all ages. Many cattle heavily infested with flukes show no symptoms whatever. But poorly nourished cattle or those infested with other parasites may become unthrifty, lose weight, and have diarrhea and anemia, if large numbers of flukes are present. Diagnosis is made by finding fluke eggs in the droppings or by post-mortem examination.

Treatment:—Hexochlorethane is a satisfactory treatment.

Control.—Liver flukes may be controlled by destroying the snail hosts on pastures and by repeated treatment of cattle.

Protozoa.—The principal protozoa attacking cattle are the Coccidia, microscopic-sized parasites which develop in the intestines and induce the disease known as coccidiosis. In the United States at least six or eight species occur commonly in cattle. They are very widespread, occurring in most herds except those grazing in very dry areas. Coccidia are usually host specific, that is, neither those attacking cattle will attack other species of animals nor are cattle susceptible to those which cause coccidiosis in other animals, such as chickens, sheep, dogs.

These parasites, multiplying within the cells of the wall of the intestine, have a complex life cycle. But they finally develop oöcysts, a form which must leave the body and undergo changes (sporulation) in contact with the air before further development in the host animal can occur.

Symptoms.—Cattle of all ages are susceptible to coccidiosis, unless they have been previously exposed. They become infected by swallowing sporulated oöcysts. Symptoms vary according to the species present and the number of oöcysts ingested. They range from a very mild diarrhea, lasting only a day or two, to loss of appetite, fever, bloody persistent diarrhea, and death. Mortality is very high among heavily infested young calves.

Treatment.—Some success has resulted from treatment with several of the sulfa drugs.

Control.—Prevention is largely a problem of management. If good sanitary practices are followed, calves on most farms are exposed to only small numbers of coccidia, but these result in a marked resistance of the animals to the disease. Calves raised on open ranges, especially in dry sections, may not be so exposed and may remain completely susceptible. Concentration of such animals in infested feed lots should be avoided, otherwise explosive outbreaks of coccidiosis may occur.

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B. T. SIMMS,

Chief, Bureau of Animal Industry, United States Department of Agriculture.

CATTLEYA. See ORCHID.

CATULLUS, Gaius Valerius, Roman poet: b. Verona 87 or 84 B.C.; d. probably 54 B.C. He is deemed by some to be Rome's greatest lyric poet, by others to be second only to Horace. His family seems to have had social standing and at least moderate means; for his father often entertained Julius Caesar, and the poet apparently never had to earn his living. While still a youth he could go to Rome and there complete an excellent education. It was in the expensive metropolis, too, that he chiefly resided, although his native town and his villa at Sirmio (Sermione) on the Lake Garda, and another not far from fashionable Tivoli, would from time to time claim his presence. His one trip abroad may have been a financial venture, but it was perhaps mainly to visit the storied cities of the East that he joined the staff of Memmius, who governed Bithynia in 57-56 B.C. The provincials proved too poor to yield profit even to an unscrupulous official, much less to one of his suite, and Catullus vented his spleen in lampoons that contrast strikingly with

the eulogies of the other great contemporary poet, Lucretius, who revered Memmius as his patron. Catullus' trip did, however, allow a visit to the grave in the Troas (Troad), of his only brother. His expressions of inconsolable grief are among the most affecting in Latin literature. In lively contrast are the two inimitable poems that voice his joy at returning home. The year's absence had at least quenched the last embers of his passion for Lesbia, who had been for some years the curse and inspiring genius of his life. According to the generally accepted theory, Lesbia is his pseudonym for perhaps the most remarkable woman of the day, Clodia, the sister of Publius Clodius Pulcher. She was at least 7, and perhaps 11, years older than Catullus, and in 61 B.C., when he fell in love with her, was the wife of Metellus Celer, a consul-elect. Apparently even Cicero did not wholly escape the fascination of this beautiful though utterly dissolute queen of the Roman "fast set." The course of the poet's liaison may be traced in a series of poems that expose his inmost feelings with a power and vividness that critics deem almost unequaled. To the period of difficult courtship belong madly passionate lyrics and the dainty "sparrow-songs." Next a lovers' quarrel and reconciliation engage our sympathies. Soon, however, the poet's faith in Lesbia's fidelity wanes, and with it all purer love, although his passion grows only the wilder and more intense. The poems in which he assails successive rivals, beginning with the brilliant but disreputable Caelius Rufus, are marvels of invective. It is only after his return from Bithynia that Catullus seems fully to appreciate the hopeless infamy of his former mistress, when he sends a scathing reply apparently to a proffer of reconciliation. While it is this cycle of love poems that has immortalized Catullus, he wrote admirably on other subjects. In spite of a life of pleasure, he had energy to study thoroughly the early Greek lyric poets, and especially the technical achievements of the Alexandrine school, which began now to have great influence upon Latin poetry. Although some direct translations from the Greek also attest his interest in these models, Catullus remained peculiarly independent. No matter how much his lyrics may show the results of his studies, they were primarily an outlet for feelings that compelled utterance, and not, like Horace's odes, a purely intellectual performance. He is less original in some of his long poems. The longest is an epithalamium, in Alexandrine style, upon the wedding of Peleus and Thetis, introducing also the story of Theseus and Ariadne. While Catullus' work in mythological epic no doubt made that of later writers, including Virgil, easier, his daring dithyrambic poem on Attis has remained unique. On the other hand, his epithalamia are the forerunners of others in Latin literature, as also of the marriage poems of Spenser, Jonson and Herrick. Horace also often appears in his odes the older poet's debtor, though in artistic form his superior. In epigram Martial (Marcus Valerius Martialis) is ready to concede the palm to Catullus as well as Domitius Marsus, though himself the acknowledged master of that form. Furthermore, in the leading elegiac writers, Tibullus, Propertius and Ovid, we clearly see their obligations to Catullus and often read his praises. He enjoyed, too, the admiration of contemporary writers, and not alone those of

his own school of poetry, like Gaius Calvus and Gaius Helvius Cinna; for the historian Cornelius Nepos seems to have started him auspiciously in his literary career. To him he gratefully dedicated a partial edition of his poems. Other famous Romans who receive kindly mention are Gaius Asinius Pollio, Quintus Hortensius Hortalus, and Marcus Tullius Cicero. Gaius Julius Caesar, however, is attacked with a fearlessness as amazing as the language is shocking. But in judging Catullus' obscenities, his liaison with Clodia, and other even less creditable relations, moderns are charitable in proportion to their knowledge of the standards of that age. Even the most severe are won to sympathy, if not affection, by happier glimpses of the poet's character. In an age of insincerity every word of his rings true. His gentler side appears in his verses on babies, flowers, and the beauties of nature, in his affection for his brother and his friends, and even in the better aspects of his love for Lesbia.

Besides the English poets already mentioned, Matthew Prior, Thomas Gray, Lord Byron, Walter Savage Landor, and Alfred, Lord Tennyson, have shown special admiration of Catullus. Among numerous excellent editions of the poet, the text edition of Robinson Ellis (1904) may be named. Besides the *Commentary on Catullus* by Ellis (1876; 2d ed. 1889), the English reader has the poetical translations of Theodore Martin (1875), those in prose by Francis W. Cornish (1913), and perhaps best of all, Hugh Vibart Macnaghten's *The Story of Catullus* (London 1899).

WALTON BROOKS McDANIEL,
Professor Emeritus of Latin, University of Pennsylvania.

CATULLUS, kătŭ-lŭs, the name of an ancient Roman family of the Lutatian gens.

GAIVS LUTATIUS CATULLUS was the admiral who defeated the Carthaginians near the Aegadian (Aegates) Isles off the Sicilian coast in 241 B.C., thus closing the First Punic War.

QUINTUS LUTATIUS CATULLUS (152?-87 B.C.) was a Roman general, historian, and poet. He was consul in 102 B.C. with Gaius Marius, and in the following year was proconsul. During his proconsulship he, with Marius, defeated the Cimbri near Vercellae (now Vercelli) in northern Italy. As one of the aristocratic party and a partisan of Lucius Cornelius Sulla, he was proscribed by Marius and committed suicide. With the exception of two erotic epigrams, nothing of his writing has survived.

QUINTUS LUTATIUS CATULLUS (d. about 60 B.C.), son of the preceding, was consul in 78 B.C. and censor in the next year. He quelled the revolutionary uprising of Marcus Aemilius Lepidus, his colleague in the consulship, and assisted Marcus Tullius Cicero in suppressing the Catilinarian conspiracy in 63 B.C.

CAUCA, kou'kă, one of the 15 departments of Colombia, South America, bordering on the Pacific Ocean; area 11,657 square miles. Originally a separate sovereign state, its sovereign rights were abolished in 1886, although some privileges, such as issuing postage stamps, were retained until 1904. Two of the ranges of the Andes Mountains, the Cordillera Occidental and the Cordillera Central, cross the department from north to south. The Cauca, Patia, and Caquetá rivers rise within its territory. No railroads exist

in Cauca, and the chief outlet is by way of the Cauca Valley to Cali, where a railroad and a highway run to the seaport of Bonaventura. Airline service between major points is frequent. The capital is Popayán (q.v.). Most of the population is in the uplands and valleys. Coffee, grown on the mountain slopes, is one of the most important industries, and tobacco, sugarcane, cacao, rice, figue, cotton, and bananas are also raised, as well as cattle. The natural resources include gold, platinum (at Belalcázar and Timbiquí), copper (Santander), silver, marble, sulphur, coal, and petroleum. Pop. (est. 1950) 454,200.

CAUCA, river, Colombia, South America, main tributary of the Magdalena River, rises in the Andes in Cordillera Central south of Popayán, and flows about 600 miles north, passing through a valley 150 miles long and 20 wide at an elevation of nearly 3,000 feet, between the high cordilleras. It descends into the left arm of the Magdalena River (Brazo de Loba) where it runs into rain forests and swamps. It is only partly navigable for small craft on its lower courses. The valley of the Cauca, where a tropical climate with abundant rainfall produces a great variety of agricultural products, is considered one of the most beautiful in the world, while it is certainly one of the most fertile. It also has rich gold placer mines.

CAUCASIAN RACE, kô-kă'shăn, commonly called the "white race," and sometimes the "Europid race," is generally considered one of the primary varieties of modern man. The designation "Caucasian" was proposed in 1775 by Johann Friedrich Blumenbach (q.v.) on the dubious theory that this racial group arose in the Caucasus region. In general, the Caucasian or Caucasoid race inhabits Europe, western Asia, and North Africa. Certain white groups (such as Finns, Hungarians, and Turks), are sometimes excluded as being too largely Mongoloid in origin. The European Caucasoids are subdivided into the Nordic, Alpine, and Mediterranean subraces, the Mediterranean grading into the stocks of western Asia, such as the Arabian and Indo-Afghan.

The Caucasoids tend to have wavy head hair, varying in color from yellow to dark brown and even black. Complexion ranges from white in Europeans to dark brown in some Indo-Dravidians. The nose is commonly narrow and prominent and the profile straight or orthognathic. See also ANTHROPOLOGY; RACES, NATURE AND ORIGINS of; and bibliographies of these articles.

JAMES H. MCGREGOR,
Professor Emeritus of Zoology, Columbia University.

CAUCASUS, kô'kă-sŭs, a huge peninsula in the Soviet Union, approximately 80,000 square miles in area, lying between the Black and the Caspian seas, and connecting the European Union of Soviet Socialist Republics with Turkey and Iran. Though the vast Kuban plain, one of the richest grain-growing areas of the Soviet Union, is sometimes considered part of the Caucasus, the actual geological and ethnographical northern boundary of the peninsula is formed by the Kuban and Terek rivers, dividing this plain from the Greater Caucasus Mountains, the highest in Europe. Below this great mountain chain is the Transcaucasian Valley, where most of the population of the Caucasus resides. On the south

of the peninsula are the Lesser Caucasus Mountains, bordering on Turkey and Iran. The climate of the Caucasus is subtropical, with hot summers and mild winters. Moist winds from the Black Sea make the west Caucasian coast a "Soviet California," ideally suited for the growing of fruit and other subtropical crops. In contrast, dry winds from the central Asian desert convert the east Caucasian coastal plain into desert and semi-desert, where agriculture is practiced mainly on irrigated land with cotton the chief crop.

Both mountain chains are abundant in minerals and provide pastures for large-scale raising of cattle and sheep. Resorts are numerous both on the Black Sea coast and in the Greater Caucasus Mountains. The rivers of the Caucasus are mostly fast-flowing mountain streams unsuitable for navigation, but with great potentialities for hydro-electric power, which is beginning to be exploited. The two largest rivers drain the Transcaucasian Valley: the Rion flowing into the Black Sea, and the Kura flowing into the Caspian. Transportation is poorly developed, most roads in the mountains being mere trails. Oxen, camels, mules, and donkeys still remain the chief means of short haul transport. Aside from well-developed coastal shipping, the peninsula's long-distance transportation depends tremendously on three railways: the old Caucasian line running from the Ukraine to Makhachkala on the north Caspian coast, thence down this coast to Baku, and across the Transcaucasian Valley to Batum; a recent line from Baku along the Iranian and Turkish border to Tbilisi (old Tiflis) via Yerevan; and the new Black Sea railway running up the west seacoast from Batum to the Ukraine. Airways link major Caucasian cities and resorts with all regions of the USSR.

Because of its isolated mountain valleys and long history as a crossroads between Europe and Asia, the Caucasus is a land of many races. There are 30 major nationalities, of which the largest numerically are the Azerbaidzhani, Georgians, Armenians, Dagestani, Ossetians, Kabardinians, and Russians. Because of this racial diversity, the peninsula is divided into 18 major administrative regions, the most important being the Azerbaidzhan, Armenian, and Georgian Soviet Socialist republics; and the Dagestan, Kabardinian, and North Ossetian Autonomous Soviet Socialist republics; Krasnodar and Stavropol territories, and Grozny Region of the Russian Soviet Federated Socialist Republic. The largest cities are Baku, Tbilisi, Yerevan, and Grozny.

The Caucasus produces over half of all Soviet petroleum; therefore oil mining and refining is the main Caucasian industry, with the greatest oil fields at Baku, Maikop, and Grozny. The manganese mines in Georgia are the largest in the world. Other important mineral products are uranium, coal from Georgia, copper from Armenia, iron ore and alunite from Azerbaidzhan, and cement rock, molybdenum, and natural gas from the northern slope of the Greater Caucasus Mountains. There are also extensive industries processing raw materials, with the largest center at Tbilisi. Agriculture concentrates on subtropical crops, the Caucasus importing part of its grain for food from the Kuban plain. The Caucasus is the second largest cotton-growing region of the USSR, yielding only to central Asia. Other major crops include grapes, tobacco, fruit, silk, and tea, all of which are exported to European Russia. Caucasian wines are famous throughout

the USSR. Wool and leather are produced on a large scale. Much fish is caught along the coasts, and valuable timber is cut in the mountain foothills.

Because of its strategic location on east-west trade routes, the Caucasus has had a stormy history and many wars. Mongols, Turks, Persians, Tatars, and empires long forgotten once ruled and fought over the peninsula. Czarist Russia conquered the Caucasus with much difficulty during the 19th century, and Russian Communists had to reconquer it in 1920. The result is a land of contrasts, a blend of Oriental and European civilizations. Pop. (1950) approximately 11,000,000.

ELLSWORTH RAYMOND,

Assistant Professor of Soviet Government and Economics, New York University.

CAUCASUS MOUNTAINS, a lofty range which stretches in a long diagonal, a little south of east between European Russia and Asiatic Georgia. The length in a straight line is about 700 miles, which various windings increase to over 900 miles. The width varies from 30 to 130 miles. Westward the mountain mass extends toward the Crimea, nearly separating the Black and Azov seas, while eastward it projects for about 50 miles into the Caspian in the Apsheron Peninsula. No fewer than 20 summits rise higher than Mont Blanc. Elbrus of the cloven crest, towering 18,481 feet, is the loftiest mountain in Europe, while at least two others exceed 17,000 feet. Among numerous peaks which have challenged mountain climbers, Ushba (15,400 feet) presents more difficult rock work than the Matterhorn. Along the northern slopes of the Caucasus, Jurassic and Cretaceous sediments predominate, but dip toward the Russian plains beneath more recent strata. Much folding took place during the Permian and Jurassic periods and continued into the Miocene. The central ranges present a core of crystalline rocks amid Paleozoic and Jurassic schists and gneisses. This crustal upheaval was accompanied by much volcanic activity and Quaternary gravels are covered by recent lava flows. Elbrus is thought to be a dead volcano, as is also the dark cone of Kazbek rising 16,541 feet, while mud volcanoes are still active in the Apsheron region. Northward the snow line ranges from 9,000 to 10,000 feet, while on the sunnier, southern heights it rises to about 11,000. More than 900 glaciers have been enumerated, but they do not descend to such relatively low levels as those in the Alps. There are few lakes, but rather a rocky chaos of beetling crags faced with sheer precipices. Hence the scenery, though impressive, is wild and gloomy rather than beautiful.

The foothills along the Black Sea, however, present views as lovely as those of Italy. The mountain slopes, particularly toward the south, are clothed with dense forests. Here is the habitat of Circassian walnut. Flowering shrubs and plants are numerous. Among characteristic wild life are the chamois and the goat-like turr. The red stag of the Caucasus has long attracted hunters, while the western wilderness was one of the last strongholds of the European bison. The Caucasus have reared a well-nigh impassable barrier between that sector of Europe and Asia. Unlike the Alps, they present a nearly unbroken wall. About midway from east to west the chain is pierced by one of the most famous of mountain passes, the Daryal, which has been excavated by

the Terek River flowing northeastward into the Caspian. Here sheer cliffs rising 6,000 feet leave barely room for the road. A few loftier passes are usually choked by snow. Hence, conquering armies approaching from Asia have been forced to outflank the mountains where they encroach upon the Caspian. In this narrow passage Alexander the Great (r. 336–323 B.C.) built a wall that was called the Gate of Iron. Even the invincible raiders of Genghiz Khan could force this defense only by stratagem.

The Caucasus are rich in minerals which include silver, copper, and less common ores. There is some quicksilver, sulphur, iron, and a great deal of coal. Near Kutaisi are to be found the world's richest deposits of manganese. Even more important are the oil wells of Baku, famous for centuries and still a leading petroleum field.

The Caucasus Mountains were prominent in Greek legend. Jason voyaged there seeking the golden fleece, and it was against their rocky flanks that Zeus chained Prometheus. Greek adventurers thought their snow-capped summits the loftiest in the world. They have always provided refuge for persecuted minorities. To their inaccessible valleys fled deserters from every invading army from the Assyrians to the Crusaders and the Turks. Prominent among the present mixture of races are Georgians, Abkhazians, Mingrelians, and Circassians. It was here that early investigators thought they had located the perfect type of the white race which is still called Caucasian. Among the mountain fastnesses villages of various nationalities rise tier above tier seeming to blend with the drab background. Two full centuries of pressure elapsed before the hardy inhabitants accepted the Russian yoke. During World War II, German outposts penetrated the region and for a brief time planted the swastika upon the summit of Elbrus.

FERDINAND C. LANE,
Author of "The Story of Mountains."

CAUCHON, kō-shōn', Pierre, French bishop: b. near Reims, France, in the latter half of the 14th century; d. Dec. 18, 1442. He is first heard of as rector of the University of Paris; in 1413 he joined the Burgundian party and was exiled by the Parlement. When his party returned, victorious, Philip the Good, duke of Burgundy, gave him a canonry at Beauvais and eventually had him made bishop in 1420. He was so unpopular that he had to leave Beauvais, and in 1429 he joined the English court, assisting at the coronation of Henry VI in Paris on Dec. 17, 1431. On May 24, 1430, Joan of Arc had been taken prisoner at Compiègne, in his diocese, and Cauchon claimed the right of judging her. He followed her to Rouen, where his conduct of the trial was particularly odious. After condemning her to life imprisonment, he changed his decision, declaring her a relapsed heretic, and handed her over to the secular arm on May 30, 1431. He could not return to Beauvais, and the king of England granted him the bishopric of Lisieux in 1432. In such execration was he held that after his death Pope Callistus IV had his body exhumed and thrown into the common sewer.

CAUCHY, kō-shē', Augustin (Louis), French mathematician; b. Paris, France, Aug. 21, 1789; d. Sceaux, May 23, 1857. Entering the Polytechnic School in 1805, he distinguished himself by the solution of difficult problems. In 1816

he won the Grand Prix of the Academy of Sciences for his paper on wave propagation. Qualifying as a civil engineer, poor health turned his attention to science, and he became a teacher. His political bias for the legitimate monarchy and the Roman Catholic faith sent him into exile in 1830 when he refused to take the oath required by Louis Philippe. Charles X made him a baron. He returned to Paris in 1837, and from 1848, when he was exempted from taking the oath under Napoleon III, until his death he was professor of mathematical astronomy at the Sorbonne. He published numerous works on mathematics, especially calculus. He invented the calculus of residues; the theory of functions of a complex variable; developed the wave theory in optics, and worked on the theory of stress in elasticity, as well as many other problems. The Academy of Sciences published his *Oeuvres complètes d'Augustin Cauchy*, in 27 volumes (1882–1901).

CAUCUS. The history of the word "caucus" has been traced to several sources, the most acceptable of which is the Algonquin *kaw-kaw-wous*, to consult. Other lines of descent go back to "caulkers," secret gatherings of dock workers in Boston, or to a Latin word for "cup"—hence a convivial gathering. A caucus may be (1) a town or community meeting to decide upon local policies; (2) a gathering of members of a party or faction to nominate candidates for elective office or to select delegates to a nominating convention; (3) a conference among party members in a legislative body to choose their leaders or to draw up a plan to promote or to oppose a specific legislative program. The Russian historian Moisei Y. Ostrogorski quoted John Adams as having said: "Our revolution was effected by caucuses. The federal constitution was framed by caucuses, and the federal administrations, for twenty years, have been supported or subverted by caucuses."

The beginning of the caucus has been ascribed by the Anglo-American historian William Gordon to the political leadership of the elder Samuel Adams during the second quarter of the 18th century (about 1735). The Caucus Club in Boston, according to John Adams' diary notation in February 1763, was regularly choosing assessors, collectors, and representatives before they were chosen in the town meeting; and the members of the caucus sent "committees to wait on the merchants' club, and to propose and join in the choice of men and measures." Samuel Adams, the Revolutionary patriot, and his father Samuel were credited with promoting the caucus for deciding upon nominations which later received formal approval in town meetings. Local committees served to correspond with committees in Massachusetts and in other colonies until a whole network of committees of correspondence operated to crystallize opinion against England. Such arrangements suggest party organization as effective and as widespread as were the later Whig and Democratic party committees. It is a logical sequence from caucus to committees of correspondence to a Continental Congress. Opinions from small groups moved into higher bodies until united action came from men who had the machinery to assert and to prove the independence of the United States. The caucus was the town device for decision and action.

The Conference.—Side by side with town caucuses there developed conferences or conventions to decide on persons to be supported in county or

district elections and later for state offices or for federal electors. The practice of thus delegating the selection of officers or slates of favored candidates was common in the counties early in the 19th century. The earliest caucus nomination for state governors was the "recommending" of candidates by rival parties in Rhode Island and Pennsylvania in 1790. In Pennsylvania the nominating body was something more than a legislative caucus (members of a given party sitting in the legislature), for it contained both legislators and delegates to the state constitutional convention. But in 1793 in that state the nominations were entirely by the party members in the legislature. Thereafter, according to Ostrogorski, the *legislative caucus* to nominate a candidate for governor was used in all states. The *congressional caucus* on the national level performed a similar service in naming party candidates for president and vice president from 1800 to 1824. Since some districts were not represented in a party caucus of legislative members at the state capital, local party leaders visited the city to sit in with the legislative caucus. This constituted the *mixed caucus*, that is, one made up of legislators and nonlegislators.

Party Discipline.—For effective support in the subsequent campaign the participants in a caucus agree in advance to support those persons selected by a majority. Party solidarity has always rested on loyal support for a party decision or for a party nomination. The nominating process has followed several patterns: (1) self-nomination; (2) caucus nomination; (3) selection through corresponding committees, who in turn presented the lists to their local caucuses; (4) conventions whose delegates were selected in a "primary" meeting of local voters; (5) legislative caucus; (6) mixed caucus; (7) mixed convention; (8) pure convention; (9) the direct primary; (10) a combination of primary and convention. See also CONVENTION, POLITICAL; PRIMARY, DIRECT.

Correspondence Men.—When the Constitution was ratified (1788), conventions of both Federalists and Antifederalists were held in Pennsylvania to prepare lists of eight persons for congressman at large for the 1st Congress under the new form of government. These conventions used methods borrowed from certain religious organizations; the Presbyterian procedure for the selection of delegates to a general synod (copied by the Federalists), and the Friends' custom of using nominating committees (copied by the Antifederalists). It may be remarked that the era of 1787 to 1793 was notable for conventions in France and in the United States. Many enthusiasts for democracy, especially in Pennsylvania, admired the democratic flowering in the early days of the French Revolution. But conventions were expensive and inconvenient for delegates who had to travel long distances. Hence, the area having the greatest number of conventions (Pennsylvania) gave way to a competing nominating procedure, the correspondence men. These industrious individuals framed lists of favored candidates through a system of exchanges. The struggle between the conference men, who wanted the convention system in order to reach a more democratic determination of the will of the common people, and the correspondence men was bound to be resolved in the most economical way. Briefly, the convention method lost favor. But oddly enough, the opposition also gave way before the rising legislative caucus, itself an inexpensive

and rather natural successor to the two previous procedures.

The Iron Law of Oligarchy.—The concept of a "wheel within a wheel" fits party politics as well as other social relationships. The tendency toward the formation of small dominating groups at the center of a social organism is seen in (1) the town caucus for nominating candidates; (2) the committees of correspondence; (3) district or state conventions; and (4) various forms of legislative caucus. These developments always point up the leadership by aggressive, industrious men who have a strong penchant for politics; who have leisure; who have wealth to correspond, to travel, and to entertain socially; who represent local points of view; and who learn the art of compromise throughout the state or nation. Parties grow, succeed, feed on success, and solidify into permanent organs. There is an aristocracy of talent, of virtue, of intellect, of wealth, of influence always directed toward obtaining and exercising power. Transitions of whatever sort reflect either concessions to demand for reform or adjustment to convenient techniques. In the new arrangement a dominating clique or organization will appear. The cry to be free from the tyranny of "King Caucus" is repeated until some mighty champion leads his people out of bondage. The emancipation is achieved by the efforts of a new political machine.

Congressional Caucus.—A peculiarity of the congressional caucus in the first quarter of the 19th century was its periodic selection of a secretary of state to succeed to the presidency—James Madison to follow Thomas Jefferson, to be followed by James Monroe, and Monroe to be followed by John Quincy Adams. "The Virginia dynasty" was broken by the elevation of Adams; and this itself came years after New York leaders in the Democratic-Republican Party of that day had pleaded for state sovereignty as against the centralized power of the Virginia clique. One of the sponsors of reform of the caucus was Henry Clay, who rose to the position of secretary of state through his support for Adams in the House contest among Andrew Jackson and Adams, and Crawford. William H. Crawford was the last man to be selected in a congressional caucus (1824). As secretary of the treasury, Crawford had conceived of the plan to use a vast network of revenue collectors as a political machine. His nomination took place before hostile spectators who had gathered to watch a caucus attended by only one third of the party members in Congress. By 1828, "King Caucus" had abdicated.

Influence on Electoral Procedures.—The influence of the caucus upon the American constitutional system may be traced briefly. The Constitution provided for the election within each state of presidential electors who were presumed to act independently at their respective state capitals in voting for president, each elector casting two votes. The candidate receiving the largest vote was to become president and the next highest to become vice president. Political parties were active while George Washington was president, but only at the prospect of his retirement did the parties view the presidential office with deep interest. Alexander Hamilton as a Federalist had little regard for John Adams, for eight years the vice president under Washington. The Federalist electors were advised by Hamilton to vote for both Adams and Charles C. Pinckney, but Hamil-

ton's hope that a few would not vote for the rather unpopular Adams—and thereby allow Pinckney to win the presidency—was not realized. As a matter of fact, the Democratic-Republican Jefferson scored a higher vote than Pinckney and thus became vice president. In the election of 1800 both parties held caucuses in secret and planned their strategy. The Democratic-Republicans won the electoral vote and proceeded to vote 73 electors for Jefferson and 73 for Aaron Burr, intending the presidency and vice presidency respectively. But since there was a tie, the presidential electoral vote was ineffective, and the House of Representatives proceeded to ballot for president between Jefferson and Burr. After many ballots and great uncertainty, Hamilton's influence was thrown to Jefferson, who thus became president by the help of the leader of the opposite party. This imbroglio led to the adoption of the 12th Amendment which provided that electors should vote separately for president and vice president.

Another effect of the caucus was the great emphasis in each state toward the general ticket for election of presidential electors as opposed to the district system. In the latter plan, each party could win a few electors, showing a reasonably proportionate strength among the voters in a given state. But state leaders were tempted to sweep the electoral slate on a general ticket, especially in large, pivotal states. The caucus encouraged the general ticket, and the general ticket produced a strongly dominant caucus. For more than a century, the general ticket has been used in all states, with the exception of Michigan in 1892. Candidates come from great pivotal states, and the concentration of campaigning falls to states with tremendous electoral strength.

Another lesson from the era of caucus government relates to a one-party situation. The argument that the caucus was necessary for unity against the political enemy lost its force when the Democratic-Republican Party had no opposition after the disintegration of the Federalist Party following the election of 1816. Furthermore, the ruling oligarchy of a one-party nation fell apart. One faction was tempted to control the caucus, and the competing faction sharply challenged the power of the caucus. When the caucus was discredited, the convention came into more general use for nominations in county, state, and nation.

Legislative Caucus.—The reasons for the legislative caucus, both state and national, were numerous: (1) It was convenient, since the legislators were at the capital for official sessions. (2) Legislators were familiar with broad problems of government. (3) They could select wisely those persons most competent to hold executive office. (4) They were official leaders in their own communities and thus enjoyed the confidence of their people.

The reasons for the persistent outcry against the legislative caucus were also numerous: (1) Some people at the base of the political system resented the assertion of power by a small clique in either legislature or Congress. (2) The Constitution forbade officeholders in the national government to serve as presidential electors, and yet the members of Congress in a party caucus took upon themselves the power to name the party candidate, thereby indirectly assuming a power withheld by the Constitution. (3) By this device the president owed his office to his party in

Congress, thus removing one of the principal checks within our constitutional system. (4) If a district was not represented in the legislative body it did not have a voice in the legislative caucus. (5) If that party was in a minority in the legislature there were relatively few districts expressing a voice through such a caucus. There was the additional taint of patronage in the hands of the executive in dealing with legislators.

Party organization in Congress employs the caucus for purposes that fall under two important heads: (1) to decide on party positions, such as floor leader and whip, to determine committee assignments, and to enable the majority party to choose a speaker in the House or a president pro tempore in the Senate; (2) to deliberate on proposed legislative measures in terms of party attitudes toward specific matters. Determination of policy is in the hands of organs recognized by the Legislative Reorganization Act of 1946 as the party conference and the party policy committee. Each party has such organs, designated as the Majority and Minority Policy committees. These are officially recognized for coordinating purposes and have their appropriations for operation with a staff of a dozen employees. The policy committees are elected by the party conference, the entire party membership in that branch acting in caucus.

Historians have rightly interpreted the democratizing forces of westward expansion as accounting for the emergence of Jacksonian egalitarianism. Frequent rotation in office, extension of the suffrage, numerous elections, exciting conventions, spoils politics, and a tremendous faith in state programs at the expense of national power, all marked the era of Democratic politics, spelled with a large and small D. But the observer may note that when the convention supplanted the former congressional and legislative caucuses, there was a quick rise of the custom of nomination in "smoke-filled rooms," which is another way of recognizing the new caucus techniques in the new political setting. These were used for choosing delegates in each state and for the eventual selection of candidates for president and vice president. The caucus moved from the halls of Congress to the key rooms in convention hotels. The word "caucus" is now spelled without a capital letter, but it is still a part of party paraphernalia.

Local Caucuses.—The caucus as a local institution is found in various towns, not only in New England but in other sections as well. The laws in many states provide for the caucus, which has to some extent become another word for direct primary. The caucus in the one state which does not have the direct primary for party nominations is provided for by law as if it were the familiar town caucus of earlier days. Yet when the Connecticut caucus law provides for the use of written ballots on request of 15 electors present at a town caucus, it definitely suggests a procedure resembling the well-known secret vote by ballot in the party primary of other states. Thus the caucus still remains, but tends to shade off into election forms of rather different character.

In England the caucus has come to signify a party gathering outside the Parliament, especially as applied to the Liberal Party caucus after 1867. "Caucus" in this sense suggests extraparlimentary party organization and local conferences or conventions.

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SPENCER D. ALBRIGHT,
Department of History and Political Science, University of Richmond.

CAUDATA. One of three orders of living Amphibia, the other two being the Salientia (such as frogs and toads) and the Gymnophiona (rare, wormlike animals of the tropics). The Caudata (by some authorities called the Urodela) includes the tailed Amphibia commonly known as salamanders and newts. Various species are found in North America, Europe, and Asia. Most members of the order have a superficial resemblance to lizards but differ in having a moist skin and lacking scales. Being amphibians they cannot live in a dry environment. Some species are found in moist earth under logs and stones, others occur in streams and lakes. The eggs are usually larger than those of frogs and toads. Development takes place in moist earth or water. The larval stages have external gills. In most species these are lost at the time of metamorphosis into the adult stage. A few species, such as the axolotl (*Stredon*) of Mexico and western United States and the mud puppy (*Necturus*) of eastern United States, are aquatic and possess gills throughout their adult life. The American newt (*Triturus*) passes its larval life in water. At the time of metamorphosis it changes into the red eft and spends several years on land. Then it undergoes a second change in body structure and coloration and returns to water to spend the rest of its life. The largest member of the order is the giant salamander of Japan. It attains a length of 5 or more feet. Most species are between 4 and 10 inches in length. Except for some Asiatic and Mexican species, which are used for food, the animals of this group are of little or no economic importance. They are of considerable interest to zoologists both in possessing many primitive vertebrate structures and for providing embryos and adults for experimental purposes.

Consult Noble, Gladwyn K., *Biology of the Amphibia* (New York 1931); Bishop, Sherman C., *Handbook of Salamanders* (Ithaca 1943); Stebbins, Robert C., *Amphibians of Western North America* (Berkeley, Calif., 1951).

JOHN A. MOORE.

CAUDEBEC-EN-CAUX, kōd-bēk'an-kō', village, France, in the Department of Seine-Inférieure, on the right bank of the Seine River, 18 miles west-northwest of Rouen. At the equinoctial high tides, the tidal wave can be seen from here, moving up the river. The 15th and 16th century church and houses were almost totally destroyed in World War II, but the templar house has been restored and turned into a museum. There is an aircraft plant. Pop. (1946) 1,575.

CAUDEX, kō'dēks, in botany, the stem, particularly the stout scaly trunk, of a tree fern or palm, or the persistent woody basal portion of a perennial herb.

CAUDINE FORKS, kō'din, a mountain pass of southern Italy, in the form of two lofty fork-shaped defiles in the Apennines, on the road

between Capua and Benevento, Campania. Here a Roman army was enticed by the Samnites in 321 B.C., and, being hemmed in, was forced to surrender.

CAUDLE'S CURTAIN LECTURES, Mrs., a series of humorous sketches by the English writer Douglas Jerrold (q.v.), published first in *Punch* in 1846.

CAUDRY, kō-drē', town, France, in the Nord Department, 40 miles south-southeast of Lille, on the government-operated railroad. Its major industries are embroideries and the weaving of fine materials; there are also sugar distilleries. In World War I the town was partially destroyed by the Germans and was occupied for a time by them in World War II. Pop. (1946) 12,091.

CAUER, kou'ēr, a family of German sculptors.

EMIL CAUER, b. Dresden, Germany, Nov. 29, 1800; d. Kreuznach, Aug. 4, 1867. He studied in Berlin under Christian Rauch. In 1825 he went to Bonn where he became instructor in art at the university; in 1832 he was appointed drawing master at the Gymnasium at Kreuznach. He invented a substitute for plaster known as the *Cauersche Masse*. Among his best works were statues of Franz von Sickingen, Charles V, and Melanchthon. He also restored antiques in the museum at Dresden.

KARL LUDWIG CAUER, son of Emil, b. Bonn, Feb. 14, 1828; d. Kreuznach, April 17, 1885. He studied with his father and with Albert Wolff in Berlin and in Rome. Among his works were the Schiller monument at Mannheim, *The Witch*, and a number of portrait busts. He designed the tomb of President James Garfield at Cleveland, Ohio. He had three sons, all sculptors: HUGO, LUDWIG, and EMIL.

ROBERT CAUER, younger brother of Karl, b. Dresden, Feb. 13, 1831; d. Kassel, April 2, 1893. He studied at Dusseldorf with his father Emil, and also at Rome. He made hundreds of small statuettes executed in the *Cauersche Masse*, whose motifs were taken from romantic or classic tales and poems. The Prussian Ministry of Public Instruction commissioned him and his brother Karl to superintend the reproduction in plaster casts of the principal structures in Italy. His son STANISLAUS was also a sculptor.

CAUGHLEY, kāf'li, site of a village in England, in Shropshire, where in the 18th century fine porcelain was made. Even before the 18th century earthenware pottery was made there, as excavations on the site have revealed. Thomas Minton (q.v.) and John Rose learned their trade at the Caughley pottery owned by a Mr. Turner, whom later they bought out. The pottery was moved to Coalport, now a famous name in English china, and the village name disappeared.

CAUGHNAWAGA, kōg-nā-wōg'ā, an Indian town, Quebec, Canada, on Lake St. Louis, opposite Lachine, about 10 miles south of Montreal. It was founded by the Jesuit missionaries in 1667 as a refuge for the Christian Iroquois who might be molested by pagan tribes.

In 1890 rule by tribal chief was changed to municipal government of a mayor and council. The Indians engage in farming, making snow-

shoes and lacrosse rackets, and guiding rafts down the Lachine Rapids. Pop. (1952) 2,240.

CAULAINCOURT, kō-lăn-kōōr', MARQUIS Armand Augustin Louis de, French soldier and diplomat: b. Caulaincourt, Aisne, France, Dec. 9, 1772; d. Paris, Feb. 19, 1827. Of noble birth, he became in 1793 a plain soldier, served in the Revolutionary armies, and was promoted general. In 1807 he was appointed ambassador to Russia and in 1808 created duc de Vicence. At St. Petersburg he tried to maintain the alliance of Tilsit, but in 1811 war broke out between France and Russia, and he returned to become aide-de-camp to Napoleon, whom he accompanied on the disastrous campaign in Russia, which he had tried to prevent. He became minister for foreign affairs in 1813 and again during the Hundred Days. After the Restoration he was on the proscribed list, but his name was removed by intervention of the emperor of Russia. His memoirs of the years 1812-1815, first published in France in 1837 and again in 1933, appeared in English as *With Napoleon in Russia* (1935) and *No Peace With Napoleon!* (1936).

CAULFIELD, kôl'fēld, city, Australia, in the State of Victoria, 6 miles southeast of Melbourne within the metropolitan area. Purely a residential suburb, it has beautiful views of mountain ranges rising to over 4,000 feet, the slopes covered with tall eucalyptus trees and shrubs. Pop. (1947) 79,913.

CAULIFLOWER, kô'li-flou-ēr (*Brassica oleracea* var. *botrytis*), belongs to the cabbage family, and has its origin in the wild cabbage still found in different forms along the coasts of the British Isles and the Mediterranean.

The number of distinct varieties of cauliflower is quite large, ranging from the small foliaged and extremely early types grown in India to the tall-growing and later-maturing Mediterranean types. They are mostly white-headed, but some are purple, some green.

In America the white-headed Erfurt and Snowball types (commonly known as cauliflower), and the cauliflower-broccoli or winter cauliflower types are mostly used. The only difference between the two lies in details of plant growth and seasonal adaptations. The cauliflower-broccoli is slower in reaching maturity and many have very definite seasonal adaptations. They are mainly grown on the Pacific coast for winter maturity. For the sake of clearness, all cauliflower-broccoli varieties should be classed as cauliflower.

The plant forms a compact white head or curd, formed by the shortened flower parts. When the head begins to develop, the leaves are drawn up together and tied, to make the heads whiter and more attractive for market. When ready to cut, usually enough leaves are left attached to the head to form protection in the container. Cauliflower prefers a comparatively cool temperature, plenty of moisture and considerable humidity, a rich loamy well-drained soil, and quite heavy fertilizing.

Seeding is done from 5½ to 7 weeks before transplanting time in greenhouse, hothed (frame), or plant bed out of doors. In some cauliflower-growing areas direct seeding is done in the field and the plants thinned in the rows.

The seed of the winter cauliflower types has

been grown in America for several years. Prior to 1940 all the seed of the Snowball types was imported from Europe, but since then it is successfully grown in some areas on the Pacific coast, where diseases such as black rot are unknown.

Cauliflower is attacked by the same diseases and insects as cabbage.

HARM DREWES,
Ferry-Morse Seed Company.

CAULKING. See **CALKING.**

CAULONIA, kou-lō'nyā, town, Italy, near the east coast of Calabria, in the Province of Reggio di Calabria, 10 miles north-northeast of Siderno Marina, on a hill 1,000 feet above sea level. It lies in an agricultural region where citrus fruit, olives, and grapes are grown.

Formerly called Castelvetero, ancient Caulonia was founded in the 7th century B.C. by Greek colonists and became a flourishing town of Magna Graecia, though it was always a dependent of Croton, a powerful colony further up the coast. When Dionysius of Syracuse defeated the first Achaean League, of which Caulonia was a member, during his conquest of southern Italy (390-379 B.C.), the town was destroyed and its inhabitants moved to Syracuse. It was later rebuilt, but never regained its former prosperity. Remains of fortifications, of a temple, and some vases were found in the vicinity. Pop. of the commune (1951) 12,996.

CAULOPTERIS, kô-lōp'tēr-īs, the name for certain stem fragments of the genus *Psaronius*, tree ferns now extinct, but occurring in the Paleozoic period. The stem fragments are characterized by the fact that they bear leaf scars in four rows. They occur in the lower Pennsylvanian (Carboniferous) beds of North America. The silicified stem fragments have been cut and polished, and sold as gems.

CAUS, kô, or **CAULS** or **CAULX**, Salomon de, Norman engineer and architect: b. Dieppe, France, about 1576; d. Paris, Feb. 27, 1626. Working in England for the prince of Wales in 1612, and in Germany for the elector palatine in 1614-1620, he returned to France to become engineer and architect to the French king. Working on hydraulic machines in 1615, he adapted hydraulic power for revolving the drum of a barrel organ. He published *Les Raisons des forces mouvantes* . . . (1615) in which he described a machine for forcing up water by steam, differing from Giovanni della Porta in having one vessel serve both as boiler and displacement chamber. On the strength of this description, although no record exists of such an apparatus having been made, the invention of the steam engine has been claimed for de Caus.

CAUSAPSCAL, kô-zăp-skāl', village, Quebec, Canada, in Matane County on the Gaspé Peninsula, and on the Matapédia River, 35 miles northwest of Campbellton, New Brunswick. It is in a dairying region and is also a resort for fishermen. Pop. (1951) 2,609.

CAUSE, in philosophy, that which brings about any change or produces any effect. The concept of cause, until recent times, has played a fundamental role in both metaphysics and the

philosophy of science. Reality has for the most part been pictured by philosophers as a cosmos, that is, an orderly whole, and causality has served as the principle of order. Aristotle's differentiation of four sorts of cause comprises the chief ways in which this principle was later interpreted: (1) efficient cause—the agency by which an effect is produced; (2) formal cause—the means or instrumentality; (3) material cause—the substance from which it is produced; and (4) final cause—the purpose or end for which it is produced. In theology, the concept of a first cause (Aristotle's "unmoved mover") has been used to establish the existence of God; the argument rests on the assumption that every sequence must have a first term, though sequences without first terms are common and consistent (e.g., the negative integers in order of size).

In scholasticism and the early modern period causality was important as entering into the orderly intelligibility of the world, a doctrine formulated in Gottfried Wilhelm von Leibniz' "principle of sufficient reason." Knowledge worthy of the name is not limited to a mere description of phenomena, but also gives an explanation of them, and explanation is ultimately causal. Initially, final causes were admissible explanations, and indeed preferred, but with the rise of modern science they increasingly gave way to efficient causation. The last great stronghold of finality was in biology, and much of the philosophical significance of Darwinism lay in its replacement of final causes by the efficient causation of natural selection.

Efficient causation itself, however, was difficult to conceptualize clearly, particularly when (as in Sir Isaac Newton's theories) it took the form of "action at a distance," for this made it impossible to picture efficiency as a matter of mechanical contact. Indeed, fatal objections to causality in this sense were formulated from a strictly empiricist standpoint by David Hume. In the conception of events of the type *A* as causing events of the type *B* are two components: (1) an invariant succession of a *B* after an *A*, and (2) a bond of necessity, constraining a *B* to occur after an *A* does. Hume pointed out that this second component never enters into experience, which manifests only the succession. Furthermore, experience does not reveal the invariance of a succession, but at most only its occurrence within the always limited range of our observations. And the inductive inference that it will also occur outside this range is justified only by the assumption of a causal connection, and so cannot be used to establish this connection on pain of circularity. Immanuel Kant attempted to reinstate causality as a category of the understanding without which experience of an orderly and intelligible world would be impossible (indeed, which is presupposed in saying that *B* objectively succeeds *A*). But this leaves unsolved Hume's problem of induction, that is, the justification for ever holding that it is indeed *A* (rather than, say, *C*) which is the cause of *B*.

The traditional philosophical conception of causality was given an influential formulation by John Stuart Mill. The famous "Mill's methods" of induction are logical consequences of the conception of a cause as a sufficient and necessary condition: the occurrence of *A* suffices for the occurrence of *B*, and *B* cannot occur without *A* occurring. The difficulties lie in determining whether in fact these relations hold.

In scientific practice causality is dissociated from any notion of efficiency or compulsion, which is regarded as a projection onto the external world of our experience of effort in bodily action on things. Causal connection is replaced by a functional relationship of a mathematical sort, one magnitude, *y*, being a function of another, *x*, if, when a particular numerical value is specified for *x*, a value for *y* is thereby determined. Here the irreversibility of the temporal order of causation is no longer important, since, when *y* is a function of *x*, *x* is an inverse function of *y*. For instance, the distance a body falls under the action of gravity being a function of the length of time it is falling, in accord with the law $s = \frac{1}{2}gt^2$, the length of time it falls is also a function of its distance: $t = (2s/g)^{1/2}$. Moreover, *y* may be a function of several variables (as in this example distance is of both time and the gravitational force); causes are not always fruitfully identifiable as single, isolable agencies. And once the mathematical function or correlation is established, no further scientific problem remains as to the agency of causal necessitation. This is not to say that intermediate connections, or relations to more general laws, are not to be searched for, but only that the efficiency of causation has no scientific content.

The doctrine that causality is universal, in other words, that every event is caused, is known as *determinism*, and is sometimes held to be a postulate of scientific method. Developments in modern physical theory—notably Werner Heisenberg's principle of indeterminacy in quantum mechanics—indicate, however, that in the realm of the subatomic, at any rate, strict determinism simply does not hold. The fixity and regularity of macroscopic events is interpreted as a statistical phenomenon, analogous to the stability of, say, suicide rates, although no inexorable destiny compels any single individual to commit suicide.

ABRAHAM KAPLAN,

Professor of Philosophy, University of California.

CAUSE CELEBRE, kōz' sâ-lëb'r' (from the French signifying "celebrated case"), a term generally applied to any criminal or civil case of special legal importance or interest, national or international. Of such are celebrated trials for political crimes, for treason, of judicial errors, of impostors, poisoners, assassins, kidnapers, or murderers.

In France a ritual murder case in which Voltaire championed the cause of the victim was that of Jean Calas, broken on the wheel in 1762; and in the 19th century the Dreyfus case (1894-1906) aroused international attention, championed by Émile Zola. In England the trial of Burke and Hare (1829) and the Tichborne case (1871-1874) were celebrated.

In the 20th century some famous *causes célèbres* were the Caillaux case (1914) in Paris; in the United States the Thaw case (1906); the Sacco-Vanzetti case (1921-1927); the Lindbergh kidnaping (1932); the Alger Hiss case (1950); and the Julius and Ethel Rosenberg case (1953).

See also ASSASSINATION; BURKE AND HARE; CAILLAUX, JOSEPH; DREYFUS, ALFRED; KIDNAPING; SACCO-VANZETTI CASE; THAW CASE; TICHBORNE TRIAL.

Consult Bataille, A., *Dramas of the French Courts* (London 1941); Roberts, C. E. B., *Famous American Trials* (London 1948); O'Donnell, Bernard, *Old Bailey and its Trials* (New York 1951).

CAUSERIES DU LUNDI, kô-zê-rês' dü lûn'dî, or **MONDAY CHATS**, the title given by Charles Augustin Sainte-Beuve to the articles which he contributed every Monday for nearly 20 years, beginning with 1849, to the daily newspapers *Le Constitutionnel* and (after 1852) *Le Moniteur*. Their 15 volumes, together with the 3 volumes of the *Premiers Lundis* and the 13 volumes of the *Nouveaux Lundis*, form an unmatched series of critical studies, of which literature is the central but by no means exclusive interest, and present a gallery of portraits in which poets and philosophers, statesmen and savants, artists and actresses, great wits, and charming and beautiful women, are painted with a wonderfully animating and revealing touch.

The range and variety of the subject matter are surprising. Few figures of significance in French life and letters of the last three centuries fail to find a place in the collection. Nor was Sainte-Beuve's view confined to his own country. He was widely read in foreign literature, particularly English. His curiosity was insatiable and his mind singularly mobile and insinuating. For such a mind criticism had to be something quite different from what it had traditionally been—a classifying and judging of literary compositions according to some definite, accepted canon of taste. The task of criticism was primarily to understand a work and a person in the light of their intention, rather than to measure them by some conventional standard. Literary works were viewed but as a partial expression of individualities, to be fully comprehended only when illumined by the light thrown upon them by complete knowledge of their author's life, times, family, friends, surroundings, circumstances, and character.

The preliminary reading that went to the making of each of these articles was prodigious. The critic could neglect nothing that could add to his knowledge of the man or woman whose work he was assessing. Sainte-Beuve did not, however, abandon standards of judgment and give himself up, like Hippolyte Taine, to explaining literature in terms of race, environment, and moment. He maintained, with increasing insistence as he grew older, the tradition of a cultivated and disciplined taste. He furthermore added to his rare qualities of intelligence and discrimination the command of an entirely adequate style, of great delicacy, brilliancy, and charm, so that the *Causeries* delight us no less than they instruct. Taken in all they constitute, with the companion series of *Portraits (Littéraires, de Femmes, Contemporains)* as imposing a body of criticism as any literature can show, and justify the almost unanimous endorsement of Matthew Arnold's estimate of their author as "the finest critical spirit of our time."

ARTHUR G. CANFIELD,

Professor of Romance Languages, University of Michigan.

Consult Trechmann, E. J., *Causeries du Lundi*, tr. with an introduction and notes, in the *World's Classics* (New York 1933).

CAUSEWAY, kôz'wâ, a raised passage across wet or marshy ground or over water, usually paved with cobblestones, pebbles, or limestone. In history it was often called a *causey*, from the Latin *calx* (lime or chalk). The most famous examples of causeways are some of the old Roman roads, the remains of which may still

be seen in parts of Europe and Great Britain, where the swamps and fenlands were bridged by causeways so well constructed as to last over a thousand years. In early New York City, a causeway was built along the old Greenwich Road, which was then on the bank of the Hudson River, and was flooded by high tides. Another early example of a causeway in the United States connected Boston Neck with the mainland. For a legendary example, see **GIANT'S CAUSEWAY**.

CAUSSES, kôs, a region of plateaus, south central France, covering parts of several departments and crossed by many rivers. It is a notable example of karst (q.v.) and an excellent region for studying the Jurassic limestone with its underground streams, fissures, potholes, prehistoric remains, and caves, which are visited in numbers by tourists. This ancient country is full of beautiful scenery, with its rivers and valleys, gorges like the Tarn, and its medieval castles and churches. On the plateaus themselves, the average altitude of which is 3,000 feet, the climate is severe. They are sparsely populated and suitable only for sheep raising. In the valleys the chief towns are Mende, Rodez, Millau, and Cahors. The Martel area produces Roquefort cheese and truffles.

CAUSTIC, kôs'tik, in *medicine*, an agent which is extremely irritant to living tissue, and sometimes causes burning or destruction of tissue. Some of the common agents are caustic alkali (the hydroxide of an alkali element), potassium hydroxide, sodium hydroxide, and toughened silver nitrate or lunar caustic. Caustics are also referred to as escharotics. They are used principally to disorganize or destroy living tissue such as warts, granulations, or superficial tumors. Other caustics are glacial acetic acid, carbolic acid, chromic acid, and the powerful mineral acids sulphuric and nitric. The hot iron is also referred to as a caustic, and tissue burned with it is said to be cauterized.

Caustic agents that are used unwisely may do serious damage since strong acids and alkalis often penetrate far beyond the area being treated. Formerly strong escharotics were used in attempts to destroy skin cancers, sometimes with disastrous results. At the present time the use of caustics in surgery is fairly limited and always has a definite purpose. In those who have been exposed to possible hydrophobia, nitric acid applied deep in the wound from a dog bite is still practiced, even though the Pasteur treatment is to be given.

In *optics*, a curve to which the rays of light reflected or refracted by another curve are tangent. It is called *catacaustic* when caused by a reflection, or *diacaustic* when due to a refraction. Mirrors and lenses so shaped as to make the caustic two intersecting straight lines will cause disappearance of spherical aberration.

HAROLD WELLINGTON JONES, M.D.

CAUSTIC SODA. See **ELECTROCHEMICAL INDUSTRIES—Caustic Soda**.

CAUTERETS, kô-à-râ', village, France, in the Department of the Hautes-Pyrénées near the Spanish border, 3,254 feet above sea level; on the Gave de Pau, 20 miles south by west of Lourdes by railroad. In summer it is a watering place where people come to take the

waters of the sulphurous springs for throat and respiratory ailments, or for rheumatism and skin diseases. Several baths dating from Roman times still exist nearby. The valley is very beautiful, with a chestnut forest, outcrops of black granite, and fine views of the mountains. In winter it is a resort for winter sports and mountain climbing. It acquired fame in the 16th century when Margaret, sister of Francis I of France, held her literary court and wrote much of her *Heptaméron* there. Pop. (1946) about 1,020.

CAUTIN, kou-tên', province, Chile, in the south central part, between the Andes Mountains and the Pacific Ocean; area, 5,519 square miles; capital, Temuco. It is drained by the Cautin, Imperial, and Toltén rivers and the lakes within its borders include Villarrica, Budi, Colico, and Caburgua. Snow-capped Villarrica Volcano, 9,317 feet high, lies within the borders of the province. Served by a state railway, steamers, and roads, the lake district attracts many tourists for its scenic beauty. Some of the major resorts are Carahue, Toltén, Villarrica, and Pucón.

The temperate climate of the province produces wheat, oats, barley, rye, potatoes, peas, and apples; cattle and sheep are also raised. There is good fishing in the lakes and forest areas are important. Flour milling, dairying, distilling, and tanning are the chief industries. Pop. (1949 est.) 321,583.

CAUTIN RIVER, Chile, in Cautín and Malleco provinces, rises in the Andes Mountains and flows about 100 miles west and southwest through the Central Valley past Lautaro, Cajón, Temuco, and Carahue to join the Quepe River three miles southeast of Nueva Imperial to form the Imperial River.

CAUTIONARY, in Scots law, an instrument in which a person binds himself as surety for another. The person executing such an instrument is known as a *cautioner*, which is the equivalent of a surety or bondsman in English and American law. Another related term in Scots law is *cautionry*, meaning suretyship. A cautionary may be either a bond to pay a debt or a written undertaking to secure the personal appearance of the party for whom the cautioner is bound.

CAUTIONARY TOWNS, three towns in the Netherlands—Brill (now Brielle), Flushing, and Ranimekens—so named because they were given to Queen Elizabeth in 1585 as security that they would repay her for assistance in their struggle with Spain. They were restored to the Dutch Republic by James I in 1616, although only a portion of the sum advanced was refunded.

CAUTLEY, kôt'li, Sir Proby Thomas, English engineer and paleontologist; b. Stratford St. Mary's, Suffolk, England, 1802; d. Sydenham, London, Jan. 25, 1871. After active service in India with the Bengal artillery, he was attached to the army engineers working on the Doab Canal, which was opened in 1830. Cautley had charge of the canal for 12 years, during which time he extended other water courses, but his greatest work was the Ganges Canal. Work began in 1843, and after some setbacks, political and others, the canal was opened in 1854. On his return to England he was made a Knight Commander of

the Bath (K.C.B.), and appointed to the Council of India.

While working in the Sivalik hills, he became interested in the fossil remains found there, and with Dr. Hugh Falconer made a great collection which was given to the British Museum, contained in 214 heavy chests. He contributed many papers to the Bengal Asiatic Society and to the Geological Society of London, which awarded him in 1837, jointly with Dr. Falconer, the Woollaston Medal. He also wrote a report in two volumes on the construction of the Ganges Canal (1860).

CAUVERY or **KAVERI** (ancient *CHABERIS*), river, India, rising in Coorg and flowing in a southeasterly direction for about 475 miles until it enters the Bay of Bengal through a wide, fertile delta, the largest arm of which is called the Coleroon. The delta has an extensive irrigation-canal system. About 35 miles east of the city of Mysore, the river is divided into two arms by the island of Sivasamudram. Each arm descends abruptly for about 320 feet to form a series of scenic rapids and cataracts called Cauvery Falls. The falls on the left arm furnish hydroelectric power. The Cauvery is filled by the monsoon rains in May and July, but it is navigable only in short sections by small boats. Often called the Ganges of the South, sections of the river at Seringapatam and Trichinopoly are regarded as sacred. The irrigation system of its delta, dating from the 2d century, is the most ancient in India.

CAVA DE' TIRRENI, ka'va dâ tîr-râ'nê, town, Italy, in the Province of Salerno, Campania, three miles west-northwest of the city of Salerno. Because of its fine location and healthful climate at an altitude of 640 feet, it is one of the most popular resorts of southern Italy. Wine, olive oil, maize, and tobacco are produced nearby. Cava de' Tirreni is a cathedral town and about two miles west is the Benedictine abbey of La Trinità della Cava, founded by St. Alferius about 1025 near the cave where he had a vision. The abbey enjoyed a period of great splendor and political power before its decline in the 15th century. Now it is national property and has a school. Some sections of the old abbey still exist, though most of the convent and the church were rebuilt in the 18th century. There are ancient frescoes, a picturesque Gothic cloister, and a collection of Lombard and Norman coins. The library includes important documents (8th-19th centuries) and illuminated manuscripts. Pop. (1936) 12,214; commune (1951) 39,086.

CAVAGNARI, ka'va-nyâ'rê, Sir Pierre Louis Napoleon, British military administrator; b. Stenay, Department of the Meuse, France, July 4, 1841; d. in battle, Kabul, Afghanistan, Sept. 3, 1879. A student at Christ's Hospital, London (1851-1857), he became a cadet in the East India Company in 1858, having been granted naturalization the previous year. With the 1st Bengal European fusiliers, he served in the Oudh campaign (1858-1859), and was decorated. His courage and ability won him the appointment of deputy commissioner at Kobat, then at Peshawar, where he took part in several expeditions against the hill tribes. In 1879 he was knighted for his services in negotiating a treaty with Yakub Khan, the new ruler of Afghanistan. While in Kabul

as British resident, the Afghan regiments mutinied and he was killed in the massacre that followed.

CAVAIGNAC, kâ-vě-nyâk', (Éléonore Louis) Godefroy, French journalist and politician, son of Jean Baptiste Cavaignac (q.v.): b. Paris, France, 1801; d. there, May 5, 1845. He took part in the revolution of 1830 and opposed the restoration of the monarchy by Louis Philippe. Taking part in the uprisings of 1832 and 1834, he was imprisoned, but escaped to England. Returning to Paris in 1841, he became one of the editors of *La Réforme*, an opposition newspaper. He was a founder of the Société des Amis du Peuple and of the Société des Droits de l'Homme in 1832, of which he became president in 1843. A fine statue of him by François Rude is in the cemetery at Montmartre.

CAVAIGNAC, Jacques Marie Eugène Godefroy, French politician, son of Louis Eugène Cavaignac (q.v.): b. Paris, France, May 21, 1853; d. St. Calais, Department of Sarthe, Sept. 25, 1905. As a schoolboy at the Lycée Charlemagne, he is said to have shown his Republican upbringing by refusing a prize from the prince imperial. He served in the Franco-Prussian War, then returned to the École Polytechnique. In 1882 he was elected to the Chamber of Deputies from St. Calais; in 1885-1886 he was under secretary of war; and in 1892 minister of marine and of the colonies.

In July 1898, while again minister of war, he forced Lieutenant Colonel Henry to confess to a forgery of certain letters bearing on the Dreyfus case, but nevertheless he declared his belief in Dreyfus' guilt. He resigned his office the following month. In 1899 he ran for president but was defeated and retired to his country home. He published *La formation de la Prusse contemporaine*, 2 vols. (1891-1898). See also DREYFUS, ALFRED.

CAVAIGNAC, Jean Baptiste, French lawyer and revolutionist: b. Gourdon, Lot, France, 1762; d. Brussels, Belgium, March 24, 1829. An advocate at the Parlement of Toulouse, he was sent to the National Convention as deputy from the Department of Lot. He rose to be one of the leaders of the Montagnards (extreme Republicans), voting for the death of Louis XVI. With his colleague Jacques Pinet, he established a revolutionary tribunal at Bayonne where he repressed his opponents with great energy. He was sent on various missions to the armies of the Moselle and the Rhine and was also a member of the Council of Five Hundred. In 1806 he became a councilor in Joachim Murat's kingdom of Naples, and during the Hundred Days he acted as prefect of the Somme. At the second restoration he was banished as a regicide.

CAVAIGNAC, Louis Eugène, French general: b. Paris, France, Oct. 15, 1802; d. St. Calais, Oct. 28, 1857. His father, Jean Baptiste Cavaignac (q.v.), played a leading part in the Revolutionary assemblies; his brother Éléonore Louis Godefroy Cavaignac (q.v.) was also an exalted democrat and a fighter for the cause of liberty and justice. Young Cavaignac graduated from the École Polytechnique, attended the military school at Metz, served in the campaign of Morea, and was appointed a captain in 1829. In 1832 he was sent to Africa, where he distinguished himself in de-

fending the French settlement against the Arabs and gained recognition as an excellent administrator and organizer. He received the rank of brigadier general in 1844 and was appointed governor of the Province of Oran. In March 1848, the provisional government of the Second Republic promoted him to the rank of *général de division* and appointed him governor of Algeria.

Soon after, Cavaignac was elected to the National Assembly by two departments, Lot and Seine. Proceeding to Paris to take his seat, he arrived there on May 17. The capital was then in a state of great excitement, because of the struggle for power between the various factions which had overthrown Louis Philippe's government: Monarchists, Republicans, Socialists, and others. The political and economic crisis was precipitated by ill-advised measures taken by the provisional government, especially by the closing of the *ateliers nationaux* (national workshops), created in order to give work to the unemployed. Cavaignac was offered the portfolio of minister of war, and on accepting took prompt and energetic steps to protect law and order. In a few days, an army of nearly 70,000 men was assembled in and around Paris. When the insurrection burst forth on June 23, Cavaignac was ready for it. After three days of tumult and bloodshed, during which more than 3,000 persons perished, the insurrection was suppressed.

On June 26, the National Assembly delegated the entire executive power to Cavaignac, who resigned it three days later, but was immediately named president of the Council of Ministers. Notwithstanding the services he had rendered, he was defeated in the elections for the presidency, in the month of December following those events. The radicals never forgave him the harsh repression of June; the Catholics and the Conservatives saw in him too strict a Republican and justly feared he would hinder the monarchist restoration they favored. Cavaignac received only 1,500,000 votes to Louis Napoleon's 5,500,000. After the coup d'état of Dec. 2, 1851, he was arrested and briefly interned in a fortress. In 1852 and 1857, he was elected a member of the legislative body but refused to take the oath of allegiance. The last years of his life were spent at his country seat in the Department of Sarthe.

Consult Deschamps, Émile, *Vie de Cavaignac* (Paris 1870); Bastid, Paul, *Doctrines et Institutions politiques de la Seconde République*, 2 vols. (Paris 1945).

PIERRE BRODIN,
Director of Studies, Lycée Français de New-York.

CAVAILLE-COLL, kâ-vî-kôl', Aristide, French organ builder: b. Montpellier, France, Feb. 4, 1811; d. Paris, Oct. 12, 1899. He was one of a family of French organ builders, including JOSEPH CAVAILLÉ, a Dominican monk, who lived in Toulouse in the first part of the 18th century; JEAN PIERRE CAVAILLÉ, his nephew and pupil (c.1740-c.1815), who made organs for southern France and Spain; and DOMINIQUE HYACINTHE CAVAILLÉ-COLL, father of Aristide (1771-1862).

Aristide Cavallé-Coll built organs for the Paris churches of Notre Dame, St. Sulpice, and the Madeleine, as well as for other churches in the provinces, and in many foreign countries. He invented the pressure method for sounding tones of different depths and heights. He published *Projet d'orgue monumental pour la basilique de Saint-Pierre de Rome* (1875).

CAVAILLON, kâ-vâ-yôn', (ancient Cabelio), town, France, in the Department of Vaucluse, on the Durance River, 13 miles southeast of Avignon at the west foot of the Montagne du Lubéron. An irrigated district, it produces excellent fruit, especially peaches and melons, and early vegetables. Its chief manufactures are tin cans and aluminum kitchen utensils.

The Romans established an important colony at Cabellio whose ruins now comprise a fragment of a triumphal arch and some tombs. From as early as the 5th century A.D. it was an episcopal city, and its present cathedral dates partly from the 12th century, with later additions. Pop. (1946) 9,412; commune 13,804.

CAVALCANTI, kâ-vâl-kân'tê, **Guido**, Florentine poet and philosopher: b. Florence, Italy, between 1250 and 1255; d. there, Aug. 28 or 29, 1300. He was a friend of Dante, who held Cavalcanti's lyric verse in high esteem (Dante's *Divine Comedy*, *Purgatory*, canto xi, 97). When the dissensions of the Guelphs and Ghibellines disturbed the public peace of Florence, the citizens banished the chiefs of both parties. The Ghibellines were exiled to Sarzana, which was so unhealthy a spot that the exiles were permitted to return; but Cavalcanti had contracted malaria, from which he died.

In his youth he made a pilgrimage to Santiago de Compostella in Galicia. Returning home through France he fell in love at Toulouse with a young lady named Mandetta. To her are addressed most of his verses, published as *Canzone d'amore*. Their beautiful style, called by Dante *dolce stil novo*, has been much admired, and many commentaries have made it their subject. The *Canzone d'amore* has been translated into English by J. B. Fletcher in *Modern Philology* in 1910, and by Ezra Pound in 1912.

CAVALCASELLE, kâ-vâl-kâ-sêl'lâ, **Giovanni Battista**, Italian art historian: b. Legnago, Italy, Jan. 22, 1819; d. Rome, Oct. 31, 1897. A student of painting at the Academy of Venice and at Munich, he traveled widely in Lombardy, Tuscany, and Rome. After his activities in the revolution of 1848, he was forced to escape to England where he became the literary collaborator of Sir Joseph Archer Crowe, with whom he produced *Notices of the Lives and Works of the Early Flemish Painters* (1857-1872); *History of Painting in Italy*, 5 vols. (1864-1871); *Life of Titian* (1877); *Life of Raphael* (English ed. 1882-1885). He was inspector of the National Museum in Florence and general director of fine arts in Rome. A new edition of his *History* was brought out by Edward Hutton, in 3 volumes (1909). A revision begun by Crowe was continued by S. A. Strong and Langdon Douglas, in 6 volumes.

CAVALIER, kâ-vâ-lyâ', **Jean**, French soldier and lieutenant governor of the island of Jersey: b. Nov. 28, 1681, at Ribaute near Anduze in Languedoc, France; d. Chelsea, London, England, May 17, 1740. Secretly brought up as a Protestant by his mother, he escaped to Switzerland at the age of 20 when threatened with persecution; but he returned on the outbreak of the revolt in the Cévennes in 1702 against Louis XIV's severe anti-Protestant measures. He became the leader of the Protestant Camisards but suffered a defeat which led to a meeting and an agreement

with Marshal Claude de Villars in 1704; Cavalier was to retain his own army and receive a colonel's commission to fight for France. Fearing treachery, however, he escaped to Switzerland. During the Spanish War in the Netherlands he raised a regiment composed largely of refugee Camisards who fought under him in Spain at the Battle of Almanza (now Almansa), where Cavalier was wounded.

In 1727 he went to England, where he received a pension, was made lieutenant governor of the island of Jersey in 1738, and in 1739 a major general. Eugène Sue made him the hero of his novel *The Protestant Leader* (1849). See also CAMISARDS.

CAVALIER, kâv-â-lêr', a term originally denoting a mounted soldier of rank as contrasted with a foot soldier; also a knight or rider. During the Civil War in England (1642-1646), the term Cavalier was given to the supporters of Charles I whose gay dress and demeanor were in sharp contrast to the austere appearance of the Roundheads who supported Parliament.

In fortifications, in earlier times, a kind of interior bastion, several feet more elevated than the principal bastion of the fortress in which it was formed. The use of the cavalier was twofold: it served either to defile the works from the fire of an enemy, or to command the trenches of the besiegers. Cavaliers were sometimes constructed in gorges or on the middle of the exterior wall, and their form was semicircular; but when they were within the bastion, they were built with straight faces and flanks parallel to those of the work in which they were placed. French cavaliers were works raised by besiegers on the glacis or slope of a fortress for the purpose of enabling them to direct a fire of musketry into the covered way.

CAVALIER POETS, a term properly applied to the group of lyrists among the followers of Charles I and of his exiled son, from the first actual warfare with the Commonwealth until the Restoration. The term is also applied more broadly to other poets of the time, such as Robert Herrick and John Donne (qq.v.), who wrote in the same style; but the distinction of the manner is due to those loyalists who were pre-eminently court gentlemen and fighters for the king.

In literary tradition the Cavalier poets took their descent from Sir Thomas Wyatt and Henry Howard, earl of Surrey; Sir Philip Sidney, Sir Walter Raleigh, and those other cultured and well-traveled "makers" of the Tudor and Elizabethan courts, who naturalized the Provençal lyric and its love system on English soil. This influence, of course, had been strong in Chaucer's time, but only with this later group did lyric poetry as an accomplishment become well established among the gentlemen around the English sovereign, and take on a native manner, truly expressive of the historical moment.

The early Elizabethan court poets, even in their narrowest imitations of the French sonneteers, had some of the largeness of the age in their manner; they spoke consciously to an audience. At the end of Elizabeth's reign the Renaissance wealth of scholarship and culture had spread through the nation, in a wide circle from the court. What remained the peculiar inheritance of the courtly poet was undergoing a refinement such as the novel shows in the second part of

John Lyly's *Euphues* (1580), in which the story is taken into the drawing room, where the feminine influence is dominant, imposing in a modern way the exquisiteness which is the end of all courts of love. By a similar transition, the courtly poets, letting go the larger subjects and the public manner, made the quality of their verse the very qualities of graceful society—the personal compliment; the brief sallies that general conversation demands; the quick turns in which grace and wit count; that method of society verse which restrains beneath an even manner all feeling that is too personal or too deep. The presence of the ladies is felt not of one woman alone; as in the garden scene in the second part of *Euphues*, the lover must find ways to woo his lady under the very eyes of her teasing comrades.

This development of the court poetry was occasioned, no doubt, by the natural growth of culture and the perfecting of manners in English society, as well as at the court. Some impression, however, was made upon the court by the change from Elizabeth's manlike rule to the gentle influence of Charles' refined queen. The influence of Henrietta Maria, however, was not altogether admirable. Refining though it was, it took the direction of effeminacy, and in the *précieuse* fashion which is fostered of insincere pedantry. William Harbington in his *ustara* (1634) illustrates the overrefinement of theme to which the graceful court verse at this moment might have seemed doomed.

The personality of Charles, however, which enlisted the loyalty of the courtiers, his tragic end, and the exile of his family and his followers, gave back to the courtly verse the vitality it was losing, and in addition some new characteristics, which distinguished it as Cavalier poetry. Loyalty to Charles and to his son, unlike loyalty to Elizabeth, was more personal than patriotic; it served to revive therefore some of the most ideal conditions of chivalry. Charles became not so much the sovereign of a country as the head of an order of knights; his exiled son became their leader under all skies. The sufferings that were the cost of their loyalty, their sense of a lost cause and the long tradition of proud breeding that would bear all with outward lightness, made the pathos and the grace of the best Cavalier poets. The Elizabethan largeness of manner never quite returned, though James Graham, 1st marquess of Montrose (1612–1650), echoed it nobly in his lines on the death of Charles I. and in those on his own execution; but in general, the lighter gracefulness continued to be a mark of the Cavaliers, as in Montrose's most famous lyric, which begins "My dear and only love." In singleness and loftiness of devotion, in the actual sacrifice of his life for the cause, and in the natural, incidental place of literature in his career, Montrose is perhaps the ideal Cavalier poet.

Richard Lovelace (1618–1658), author of the best known Cavalier lyric, "Tell me not, sweet, I am unkind," and of the only less perfect *To Althea, from Prison*, illustrates in his life, as does Montrose, the tragedy that often underlay this graceful verse, but the tragedy here is one of sentiment. He impoverished himself to give his fortune to the king. On returning from the wars abroad, he was imprisoned, and his "Lucasta," Lucy Sacheverell, believing him dead, married someone else. Lovelace died worn out by suffering and poverty.

A similarly typical fate was that of Sir John

Suckling (1609–1642), who spent his fortune for the king, became an exile, and died abroad. He wrote several plays and the clever *Session of the Poets* (1637), the model of much later criticism in light verse; his fame, however, is founded on his Cavalier poems. In his life and in his writing he is neither so noble nor so pathetic as Montrose and Lovelace; he is a roisterer at heart, as can clearly be seen even in the exquisite *A Ballad Upon a Wedding*. But he is master of the reckless tone that finally characterized the school, the tone that had been caught so finely by George Wither (1588–1667)—who strangely enough lived to be a Roundhead—in his "Shall I, wasting in despair?" In such lines as "Out upon it, I have loved three whole days together," Suckling turns the bravado note into a pretty compliment; in his best lyric, the song from *Aglaure*—"Why so pale and wan, fond lover?" he carries it to its logical conclusion of recklessness.

Among the numerous poets who wrote in the Cavalier manner, though not under strict Cavalier conditions, besides Herrick and Donne, already noticed, should be mentioned Edmund Waller (1606–1687), for his two perfect lyrics of compliment, *On a Girdle and Go, Lovely Rose*. But far more important is Thomas Carew (1595?–?1639), probably the most gifted minor poet of the time, with the exception of Herrick. He came of good family, enjoyed an excellent education, and, it seems, led a reckless life. In his verse the Cavalier compliment is most elaborate and most noble, as in the incomparable *To Celia*, beginning "Ask me no more," and in the epitaphs on Lady Mary Villiers, where he is indeed more the scholar than the Cavalier. "Give me more love or more disdain," and "He that loves a rosy cheek," are other familiar examples of his felicity. He had in full measure the rhetorical grace of the true Cavalier, the secret of splendid openings and cadences—an unacademic art that began not in literary imitation but in courtly conversation, in the fine compliment paid to beauty that need not be abashed by praise.

JOHN ERSKINE,
Professor Emeritus of English, Columbia University.

CAVALIERE SERVENTE. See CICISBEO.

CAVALIERI, kă-vă-lyă'rê, **Emilio de'** (also EMILIO DEL CAVALIERE), Italian composer: b. Rome, Italy, 1550?; d. there, March 11, 1602. His music, which differed from most compositions of his time in its simple melodic quality, attracted the attention of the intellectual Florentine families, and he became inspector general of arts and artists at the Medici court at Florence from 1589. He was one of the originators of *basso continuo* accompaniment and a promoter of the new *stile recitativo*. Some of his dramatic compositions are *Il Satiro* and *Il Giuoco della cieca* (1590); *La disperazione di Fileno* (1592); *La Rappresentazione di anima e corpo* (1600), the latter once considered the first oratorio, but really a morality play set to music.

CAVALIERI, **Francesco Bonaventura**, Italian mathematician: b. Milan, Italy, 1598; d. Bologna, Nov. 30, 1647. At the age of 15, he entered the Jesuit Order, and was sent to the University of Pisa to study mathematics, for which he showed an early bent. His teacher

there was Benedetto Castelli, a disciple of Galileo. From 1629 until his death he was professor of mathematics in Bologna, and was the author of several mathematical works, the most important of which was entitled *Geometria indivisibilibus continuorum nova quadam ratione promota*. Since he expressed in this work some original ideas concerning the abstruse sciences, the Italians claim him to be the inventor of the infinitesimal calculus. It is indeed true that his method of indivisibles enabled him to attain certain results which are now reached by the integral calculus, but Cavalieri made the false step of regarding a plane figure as the sum of a finite number of narrow rectangular strips and a solid figure as the sum of a finite number of cylindrical laminae, instead of considering the figures in question as *limits* of such sums.

CAVALIERI, Lina, Italian dramatic soprano: b. Rome, Italy, Dec. 25, 1874; d. near Florence, Feb. 8, 1944. A pupil of Mme. Mariani-Masi in Paris, she made her debut at Lisbon, Portugal, in December 1900, later singing in most of the large opera houses on the Continent. She made her debut at the Metropolitan Opera House in New York City on Dec. 5, 1906 as Fedora in Giuseppe Giordano's opera of that name. In 1909-1910 she appeared at the Manhattan Opera House, and in 1915 with the Chicago Opera Company. The roles which gained her the highest acclaim were those of Thaïs, Manon, and Herodiade. In 1913 she married the tenor Lucien Muratore, from whom she was later divorced. Retiring to Italy on the outbreak of World War II, she was killed during an American air raid.

CAVALLA. See KINGFISH.

CAVALLERIA RUSTICANA, *kä-väl-lä-rë-ä roös-të-kä-nä* (RUSTIC CHIVALRY), the title of a famous short sketch by Giovanni Verga, recounting how an "affair of honor" was settled in a country place in Sicily. The story first appeared in 1880 in a collection of tales entitled *Vita dei campi* (*Life in the Fields*) and subsequently, when the stories were reprinted, gave its name to the collection. The direct way the story is told, without any elaboration, leaving to the imagination precisely what is necessary, makes the tragedy a model of this kind of realistic writing, a kind which has given Verga a very high rank among 19th century Italian writers.

Turiddu Macca, a young soldier, returns from military duty to find that his sweetheart, Lola, during his absence has given her hand to a well-to-do villager, Alfio. To revenge himself, Turiddu wins the affection of a young girl, Santa, living directly opposite Lola, and then endeavors to make the latter jealous. He succeeds, abandons Santa, wins back Lola, and pays for his treachery with his life, in a duel with Alfio. Such are the bare facts. The way they are presented in rapid succession leading up to the tragedy is realism of the highest order. Moreover, the local coloring is so strong as to give the sketch a flavor that is peculiarly Italian, and which characterizes thoroughly everything that is presented in the tragedy: Turiddu's uniform and red cap with the tassel worn by the Bersaglieri, which strangely agitate the young girls and attract the small boys; his reproach in Sicilian dialect to Lola, just before her marriage; the ostentation of the latter after her marriage, in displaying her jewels and

ornaments from the balcony of her house to proclaim her wealth; the courtship of Turiddu and Santa, broken by Lola's jealousy, and the resulting consequences, that is, the challenge of Alfio to Turiddu; the binding of the promise to fight the duel by embracing, and by Turiddu's biting Alfio's ear; the duel at sunrise in the Indian fig field, where Alfio, wounded, stoops down, picks up a handful of dust, throws it into his opponent's eyes, thus blinding Turiddu, making it possible for Alfio to wreak his revenge by dispatching the betrayer of his honor.

In 1884 Verga dramatized *Cavalleria rusticana* as a one-act play containing nine scenes. Several minor characters appear and Santa is called Santuzza. The whole action takes place Easter morning in the village *piazzetta*, where the wine shop of Turiddu's mother, Nunzia, is seen, and the village church. Although Verga's dramatized version is effective, the drama is hardly the equal of the *novella*, the charm of which in no small degree lies in the merely suggested background.

Undoubtedly much of the celebrity of *Cavalleria rusticana* is due to Pietro Mascagni's opera of the same name, the libretto for which was written by Ottaviano Targioni-Tozzetti and Guido Menasci, shortly before 1890. Although the original version of the story is followed quite closely, several lyrics are introduced serving as texts for arias and choruses, which, admirable as they are in their way, by reason of their development rather detract from the original dramatic effect. (See CAVALLERIA RUSTICANA, the opera.)

An English translation by Alma Stretell appeared in England in *Cavalleria Rusticana and Other Tales of Sicilian Life* (1893); also one in the United States by Nathan Haskell Dole in a volume entitled *Under the Shadow of Etna* (1896). A readily available text of *Cavalleria rusticana*, with English notes and commentary, by Professors E. H. Wilkins and R. Altrocchi of Chicago University, will be found in a collection *Italian Short Stories* (1912).

JAMES GEDDES, JR.,
Professor Emeritus of Romance Languages, Boston University.

CAVALLERIA RUSTICANA, a grand opera in one act by Pietro Mascagni (libretto by Ottaviano Targioni-Tozzetti and Guido Menasci, founded on a tale by Giovanni Verga), first produced at Rome, May 17, 1890. Awarded the prize in a competition for one-act operas offered by the publisher Sozegno, *Cavalleria Rusticana* launched its composer into worldwide prominence, and founded a school of well-defined proportions. All Italy went wild over the work and Mascagni was hailed as the legitimate successor of Giuseppe Verdi. Everywhere the opera created a furore. In New York two managers vied with each other to be the first in the field, with the result that two productions were given in New York on Oct. 1, 1891, and the question of priority rights had to be settled by the courts. In the meantime, both Philadelphia and Chicago had heard it. The compressed emotional appeal of the work swept critical judgment off its feet. The hot-blooded passion of the story was raised to a higher power by the music. The *Intermezzo* alone was an eloquent advance agent of the opera. The work established the so-called *verismo* school of Italian opera, dealing with contemporary matters in realistic fashion. The Siciliana sung by Turiddu, Santuzza's romance, the Drinking Song and Lola's aria are often heard in concert. Operatic annals contain few such sensational and meteoric careers as that of *Cavalleria Rusticana*. For

more than half a century it has been often paired with Ruggiero Leoncavallo's *Pagliacci* as a double bill in the operatic repertoire. For the outline of the story see CAVALLERIA RUSTICANA.

For a detailed account of its premiere in New York and for an appraisal of the opera consult Krehbiel, H. E., *Chapters of Opera* (New York 1908).

CAVALLI, kă-väl'lê, **Pietro Francesco** (originally PIETRO FRANCESCO CALETTI-BRUNI), Italian composer: b. Crema, Italy, Feb. 14, 1602; d. Venice, Jan. 14, 1676. The name by which he is known was assumed by him in 1640 in honor of his patron Federico Cavalli, mayor of Crema. He studied in Venice under Claudio Monteverdi, whose style he continued. In 1665 he became organist at St. Mark's, and *maestro di capella* in 1668, an office he retained until his death.

He is best remembered for his work in dramatic operas, in which he introduced solos, freer rhythm, and widened the scope of dramatic possibilities. He was the direct forerunner of Alessandro Scarlatti who developed opera along these lines. In spite of obvious crudities of style and weakness of harmony, Cavalli's 42 operas are still noteworthy productions. Among them may be mentioned *Le nozze di Teti e Peloo* (1639); *Il Giasone* (1649); and *Ercole amante* (1661). About 1656, a collection of his church music was published in Venice.

CAVALLO, kă-väl'lò, **Tiberio** (English TIBERIUS), Italian physicist and inventor: b. Naples, Italy, March 30, 1749; d. London, England, Dec. 21, 1809. Very early in life he moved to England where he published in 1775 a notice of *Extraordinary Electricity . . . Observed at Islington*. He invented several ingenious instruments for electrical and chemical experiments. His apparatus for measuring the force and quantity of electricity is remarkably delicate and accurate. In 1779 he was admitted to the Royal Society. His study of the influence of air and light on plant development was brilliantly original and paved the way for valuable discoveries in organic life. He wrote *Theory and Practice of Medical Electricity* (1780); *A Treatise on the Nature and Properties of Air . . .* (1781); *Complete Treatise on Electricity* (1786); *A Treatise on Magnetism in Theory and Practice* (1787); *Elements of Natural and Experimental Philosophy*, 4 vols. (1803); and other scientific works.

CAVALOTTI, kă-väl-lòt'tè, **Felice Carlo Emanuele**, Italian politician and writer: b. Milan, Italy, Dec. 6, 1842; d. Rome, March 6, 1898. A fighter under Giuseppe Garibaldi and a political journalist, contributing to *Unità Italiana* and other newspapers, he was elected to the Italian Parliament in 1868. There he violently opposed Francesco Crispi for his stand on the monarchy, and became the leader of the radical Republicans. He served several terms in prison and fought 32 duels, being killed in the 33d. In his verse he frequently attacked the government. Some of his plays were *Agnese* (1873); *Guido* (1873); *I Merseni* (1877); *La sposa di Menecle* (1882); *Il Povero Piero* (1884). A complete collection of his works was published in Milan, in 10 vols. (1895-1896).

CAVALRY, kăv'äl-rî, that part of the military forces which serves on horseback. Cavalry has always been characterized by its mobility and by its shock action (the impact of charging horse-

men in close formation). These capabilities made cavalry the decisive influence in military operations until the introduction of muskets and artillery. Cavalry has been used for a number of missions besides attack in battle. These include (1) reconnaissance; (2) counterreconnaissance; (3) delaying action; (4) outpost duty; (5) conduct of raids; (6) pursuit.

Ancient Times.—Cavalry's development as a distinct arm followed the breeding of horses capable of carrying an armed man. By 772 B.C. lancers and mounted bowmen began to replace the chariot warriors of the Assyrian Army. The Medes and Persians, who successively replaced the Assyrians, depended mainly on horse archers. In western Europe, this evolution was slower. Xenophon mentions the use of cavalry during the First Messenian War (begun 743 B.C.), but its first employment in sizable units seems to have been at Leuctra (371 B.C.) where Epaminondas used it to secure his flanks. Philip II of Macedon (r. 359-336 B.C.), after studying these tactics while a hostage in Thebes, made cavalry the decisive arm of the professional army he raised on his return to his kingdom. Fixing the enemy by the frontal attack of his massive infantry phalanx, he would throw his heavy cavalry against their flank. Such knee-to-knee charges demanded excellent riders and careful training, since this early cavalry had neither saddles nor stirrups and could be easily dragged from their horses. Philip's army also included light cavalry for reconnaissance and skirmishing. Alexander the Great (r. 336-323 B.C.) inherited this army. At the river Granicus (334 B.C.), he defeated the more loosely organized Persian cavalry; at Issus (333 B.C.), his heavy cavalry rolled up the Persian left flank; at Arbela (331 B.C.) it led the attack through the gap which by clumsy maneuvering the Persians had opened in their center, and pursued the defeated army to its destruction. At the Hydaspes (326 B.C.), it took a stronger Indian army in flank and rear and so disorganized it as to make it easy prey for Alexander's infantry. Alexander was even able to defeat the nomadic Scythians.

Early Rome did not develop an efficient cavalry. This lack brought it repeated defeats in the Second Punic War (218-201 B.C.). Hannibal's heavy cavalry, modeled after Alexander's, was the most effective part of the heterogeneous Carthaginian Army. Though the Roman legions were superior to the Carthaginian infantry, they were shattered by cavalry attacks against their rear at the Trebia (218 B.C.) and Cannae (216 B.C.). Moreover, Hannibal's Numidian light horse was unequaled for scouting and outpost duty. Taught through bitter experience, Rome eventually built up its cavalry. In Africa, Scipio won over the Numidians. Hannibal returned to defend Carthage, but at Zama (202 B.C.) the Roman cavalry rode his horsemen off the field, then turned to strike his infantry from the rear. Carthage defeated, Rome again neglected its mounted arm. Consequently, Roman expansion eastward was blocked by the Parthian horse archers.

Early Christian and Medieval Eras.—Saddles, and then stirrups, appeared in the first centuries of the Christian era (the exact dates are not known). These innovations gave the cavalryman a firmer seat and made shock action more effective. The Goths probably used both in their annihilation of a Roman army at Adrianople

(378 A.D.). Thereafter, European cavalry evolution followed divergent paths. In the Eastern Rome (Byzantine) Empire, war was a science. Its armored horsemen, equipped with bow and lance, combined mobility, firepower, and shock action to a unique degree; such professional soldiers preserved their empire until the unnecessary disaster of Manzikert (1071 A.D.). In the West, under the new feudal system, warfare was the function (and recreation) of the nobility. The knight relied upon shock action alone. His mobility was relatively low, both from the weight of his equipment and the complete lack of any military organization. Medieval armies were temporary collections of local contingents, led by an individualistic gentry. Medieval cavalry reached its maximum efficiency during the 13th century under Charles I, count of Anjou, and Simon de Montfort. Thereafter, the increasing use of plate armor further reduced mobility to a point where armor was observed to be an excellent thing—it protected its wearer, and hindered him from injuring anyone else. At the same time, class tradition and past successes made the knight arrogantly confident in the invincibility of his ponderous charge. Therefore, the next two centuries saw him repeatedly defeated by Flemish and Scottish spearmen, English archers, Swiss pikemen, and the Hussite *wagenburg*.

Meanwhile, Genghis Khan (c.1162–1227 A.D.), one of the greatest cavalymen in history, made an empire out of the restless Mongol tribes. Carefully organized, thoroughly disciplined, his mounted army was followed by wagon trains, spare horses, and herds of livestock, giving it a capacity for sustained operations never before seen. Masters of deception, the Mongols maneuvered swiftly in widely separated columns, and concentrated unexpectedly on the enemy's flank or rear. In combat, they employed evasive tactics, luring their opponents into ambush and wearing them down by incessant archery before committing their armored lancers for the final attack. Victories were exploited by merciless pursuit. In 1241, their raiding columns reached the Adriatic. Fortunately, family feuds broke up their empire by 1300.

The 15th Through 18th Centuries.—The Hundred Years' War saw the introduction of artillery and put war on a more professional basis. Charles VII of France (r. 1422–1461), formed a permanent force of regularly paid heavy cavalry—the *Compagnies des Ordonnances du Roi*. To resist heavy cavalry, infantry armed with 18-foot pikes and covered by arquebusiers formed in masses too dense for horsemen to ride over. Cavalry countered by abandoning the lance for the pistol. Advancing at the trot in columns 12 or more ranks deep, these pistoleers (*reiters*) would fire by rank at close range, wheeling back to the rear of their formation to reload. Leg armor was abandoned, but breastplates were thickened. Various types of irregular light horse (*stradiots*, *argoulets*) were employed.

These slow tactics of the 16th and 17th centuries were upset by Gustavus Adolphus (r. 1611–1632) of Sweden, who taught his cavalry to charge at the gallop, the front rank only firing, then taking to their swords. Once this combination of firepower and shock action had swept away the hostile horse, the Swedish cavalry swung back to help their infantry. Artillery might support these charges. This return to classical tactics was carried on by Oliver Cromwell;

Louis II, prince de Condé; Henri, vicomte de Turenne; Charles XII of Sweden; and John Churchill, duke of Marlborough. Armor largely disappeared. Dragoons appeared as a separate arm about 1554. Cavalry was employed in mass. Frederick the Great (r. 1740–1786) brought cavalry to one of its highest points by strict and unceasing training and careful selection of commanders. It played a major part in most of his victories, especially the Prussian triumphs of Rossbach (1757) and Zorndorf (1758). Its major missions were close-in security and combat. The American Revolution saw little cavalry fighting because of the difficulty both sides experienced in securing sufficient horses and forage.

Napoleon and the 19th Century.—Napoleon Bonaparte evolved the concept of the cavalry screen, which covered the advance of his army, smothered enemy reconnaissance, and collected information. He also developed a cavalry reserve, mostly composed of his cuirassed heavy cavalry which he raised from one regiment in 1800 to 16 in 1810. Once the hostile army was fixed by his light cavalry and advance guard, Napoleon selected the vital spot in its position, massed his artillery there, and literally blew a hole through which he poured the reserve cavalry. Generally these tactics worked, from Austerlitz (1805) to Ligny (1815). At Eylau (1807) the cavalry had to be committed too soon; at Leipzig (1813) it was too weak; at Waterloo (1815) the cavalry attacks over rough terrain against infantry in position met with disaster. The loss of most of his veteran troops and trained horses in Russia (1812) made Napoleon's victories in 1813 barren. There could be no effective pursuit. It must be remembered that the infantry of this period was armed with a muzzle-loading musket, inaccurate even against massed troops at ranges much over 200 yards. It was slow to load, and wet weather left it useless. Infantry in squares might stop cavalry alone, but not cavalry supported closely by artillery and infantry skirmishers.

The years after Waterloo saw great improvements in infantry weapons, but none in cavalry employment. The Crimean War (1853–1856) and the Austro-Prussian or Seven Weeks' War (1866) produced numerous examples of cavalry dash and spirit, but none of its intelligent use. It was the American Civil War (1861–1865) which begot an entirely new concept. Starting with a plentiful supply of good horsemen and horses, the South was able to form effective cavalry units. Until 1863 they operated with almost complete freedom. Though seldom successful against infantry, they raided Northern communications almost at will. Brig. Gen. J. E. B. Stuart, furthermore, screened Gen. Robert E. Lee's army in a masterful fashion, while keeping him informed of every Union movement and weakness—for example, the vulnerability of Brig. Gen. Joseph Hooker's right flank at Chancellorsville. Northern cavalry developed slowly, learning like the Romans from its defeats. The adoption of the repeating carbine gave it an effective weapon, and by 1863 it began to seize the initiative. At Gettysburg (1863), Lee found himself unexpectedly engaged because the overly optimistic Stuart had committed himself to a fruitless raid instead of searching out the Northern Army. By contrast, the first Federal cavalry commander on the ground, Maj. Gen. John Buford, stopped Lee's advance for vital hours by dismounted action

west of Gettysburg. The cavalryman produced by the Civil War was a professional soldier of the highest type, equally ready for shock action with saber and revolver, or for dismounted fighting. Extremely mobile, supported by expert horse artillery, he could maintain himself in hostile territory and even storm fortifications. One feature of cavalry operations in the Civil War was the tendency toward indiscriminate raiding (usually to the neglect of more important missions) which ruined horses and produced headlines— but few other tangible results.

In Europe the many lessons of the Civil War were largely ignored. The Franco-Prussian War (1870–1871) brought out thousands of cavalry, armed and trained only for mounted action. The Prussians were at least usually active in screening and scouting; the French died bravely in futile charges against unshaken infantry.

Early 20th Century.—The South African (Boer) War (1899–1902) taught the British the importance of firepower for cavalry. The conventional type Russian cavalry, though greatly superior in number, accomplished nothing during the Russo-Japanese War (1904–1905). Nevertheless, World War I found the 10 French cavalry divisions unprepared for dismounted warfare; the 11 German divisions only partly so. Both sides frittered away their mounted forces in small detachments, the French killing a great number of their horses in aimless forced marches which had no effect whatever on the fighting. On the eastern front, the Russians finally mobilized a total of 54 cavalry divisions, yet this vast force was scattered all along the front and was of very little use. By contrast, when the two Russian armies under Gen. Pavel Karlovich Rennenkampf and Gen. Aleksandr V. Samsonov invaded East Prussia in 1914, a single German cavalry division delayed Rennenkampf's entire army long enough for Gen. Paul von Hindenburg to concentrate all other available German forces and crush Samsonov at Tannenberg.

Only in Palestine, in 1918, was there effective large-scale cavalry action in World War I. There Gen. Edmund Allenby produced a modern version of the Napoleonic attack—and a preview of World War II armored warfare—by shattering the Turkish right with infantry and artillery and pouring three cavalry divisions through the resulting gap. This cavalry exploitation and pursuit was supported by combat aviation. The improvement in automatic weapons, motor vehicles, radio, tanks, and planes after World War I seemed to leave no mission for horse cavalry. Aviation took over long-range reconnaissance; the machine gun and barbed wire prohibited charges on the battlefield. Most nations replaced the horse with the tank and armored car.

Only Poland, France, and Russia had considerable numbers of mounted men at the beginning of World War II, and these units were stiffened by the incorporation of motorized infantry, antitank weapons, and light armored vehicles. The Polish cavalry was destroyed with the rest of its army in 1939; the greater part of the French horsemen were caught in the German Ardennes breakthrough of 1940 and suffered a like fate. The Russian cavalry lost heavily in attacks on the German armored spearheads during the early part of 1941. Nevertheless, it was soon evident that sizable cavalry units could infiltrate the thinly stretched German lines and deliver attacks deep in the German rear. The

Russian cavalry seems to have normally attacked dismounted, and to have depended on darkness or the extensive forests for concealment from hostile aviation. The Germans increased their own cavalry to meet this threat, and employed mounted units of local sympathizers whenever possible. The use of cavalry on other fronts was as follows: both sides used small forces of cavalry on the Italian front; the 26th Cavalry Regiment (Philippine Scouts) covered the withdrawal of Gen. Douglas MacArthur's forces to Bataan; and both China and Japan employed large numbers of horse cavalry.

Position Today.—In the mid-1950's cavalry has become an arm for use in rough country where infantry moves slowly and motor vehicles cannot leave the few poor roads. Opportunities for shock action are few, though possibly effective due to their sheer unexpectedness. On the other hand, the improvement in automatic and recoilless weapons has increased the cavalry's firepower. With atomic warfare making a greater dispersion of ground forces a necessity, horse cavalry may still find definite, if limited missions. Russia is the only major power to retain horse cavalry as a combat arm. Armored units have taken over the combat missions, even the unit designations, of the cavalry. The armored division has replaced it on the battlefield, and the light tanks of armored cavalry regiments share its reconnaissance mission with military aviation. Shock action is no longer the physical and moral impact of massed horses and men, but of advancing armored vehicles and their firepower. The weapons have changed, but the spirit and traditions remain.

V. J. ESPOSITO,
Colonel, United States Army; Professor of Military Art and Engineering, United States Military Academy.

CAVAN, kāv'ān, 10TH EARL OF (FREDERIC RUDOLF LAMBERT), British soldier: b. Oct. 16, 1865; d. London, England, Aug. 28, 1946. He began his military career as aide-de-camp to the governor general of Canada in 1891–1893. In 1901 he served in the South African War and was mentioned in despatches. During World War I he commanded the 14th Corps, then the Brigade of Guards, and was promoted lieutenant general and made a Knight Commander of the Bath (K.C.B.). In 1918 he was in charge of operations of the 10th Italian Army on the Piave front. Promoted general in 1921, he headed the British War Office section of the delegation at the Washington Conference. From 1922 to 1926 he was chief of the Imperial General Staff, and was made colonel of the Irish Guards, an honor he retained the remainder of his life. He was created a field marshal in 1932.

CAVAN, county, Ireland, inland in the Province of Ulster, bounded on the north by Fermanagh and Monaghan, on the south by Meath, Westmeath, and Longford, and on the west by Longford and Leitrim. Its greatest length (including a long, protruding neck) is 57.5 miles and its greatest breadth, 27 miles; area 729.9 square miles. The Gaelic name, an Chabháin, signifying a hollow, comes from its low-lying central area covered with lakes. Originally Cavan was named East Breffni. The plain around Ballymagauran on the Leitrim border was the ancient pagan site of Magh Shleacht

where the pagan Irish worshiped the idol Crom Cruach. In the northeast in a wild district of mountain and bog is Cuilcagh Mountain (2,188 feet) at the foot of which the river Shannon rises. The river Erne with its tributaries flows through the center of the county. The land is hilly and not very fertile. Cavan is a county of small, frugal farmers. Oats, potatoes, and flax are grown. Near Bailieborough there is a large deposit of gypsum which is mined. The principal towns, all small, are Belturbet, Cavan, Kingscourt, Bailieborough, and Cootehill. Cavan is the county of the O'Reilly clan. Pop. (1951 prelim.) 66,412.

CAVAN, urban district, Ireland, county seat of County Cavan, 65 miles northwest of Dublin, on the Great Southern Railway, and terminus of a branch of the Great Northern. The chief section of the town was burned in 1690 when the duke of Berwick was defeated. It is an agricultural market for livestock and potatoes, and some trade in linen is carried on. Nearby is the seat of the Roman Catholic bishop of Kilmore. Pop. (1951 prelim.) 3,564.

CAVANILLES, kã-vã-nẽ'lyãs, **Antonio José**, Spanish botanist: b. Valencia, Spain, Jan. 16, 1745; d. Madrid, May 4, 1804. In 1777 he went to Paris, where he studied for 12 years, chiefly in the field of botany. In 1785-1786 he published his great botanical work *Monadelphiae Classis Dissertationes decem*, with 300 engravings. After his return to Spain he wrote *Icones et Descriptiones Plantarum Hispaniae*, 6 volumes, with 601 engravings (1791-1801). He became director of the Royal Botanical Gardens of Madrid, where he increased the collection to 12,000 species. In pursuance of a commission from the king of Spain, he collected materials for a work on the natural history of Spain, two volumes of which, on Valencia, were published at the expense of the king in 1795-1797. The plan to include all of Spain was not completed.

His nephew ANTONIO CAVANILLES (1805-1864) was a distinguished counselor and the author of a history of Spain (Madrid 1859-1864).

CAVATINA, kã-vã-tẽ'nã, (It. diminutive of *cavata*), in music, a short operatic air without repetition of words or phrases. The cavatina is composed in one section. The term *cavata* means an "extraction" but it is used to designate an epigrammatic sentence. Hence the cavatina is literally a little musical sentence.

The cavatina was used frequently in 18th and 19th century operas, and the name has also been applied to instrumental pieces of lyric character. Some notable examples are "Largo al factotum" and "Una voce poco fa" from Gioacchino Rossini's *Barber of Seville*; "Come per me serena" from Vincenzo Bellini's *Sonnambula*; a cavatina for basso buffo is found in Gaetano Donizetti's *Elisir d'Amore*; "Udite, o rustici," while the tenor cavatina in Charles Gounod's *Faust*, "Salut! demeure chaste et pure," is wellknown. Felix Mendelssohn's "Be thou faithful unto death" from his oratorio *St. Paul* is listed as a cavatina in the orchestral score, although more often it is classed as an aria. The title of cavatina is also given to the fifth movement of the great string quartette in Opus 130 by Ludwig van Beethoven.

CAVAZZOLA, kã-vãt-tsô'lã, or **CAVAZ-**

ZUOLA, Il, (real name PAOLO MORANDO), Veronese painter: b. Verona, Italy, 1486; d. there, 1522. A pupil of Francesco Bonsignori, he was considered one of the best of the Veronese school. Some of his paintings were: *Baptism of Christ*; *Madonna in Glory* (an altarpiece); *St. Rocco* and *Madonna and St. John the Baptist*, both in the National Gallery, London; of his portraits, *Ritratto di gentiluomo*, particularly fine, was in the Dresden Gallery, Germany.

CAVE, kãv, **Edward**, English printer: b. Newton, Warwickshire, England, Feb. 27, 1691; d. St. John's Gate, London, Jan. 10, 1754. After a short sojourn at Rugby School, he became apprenticed to a London printer named Collins, who sent him to Norwich to run a weekly paper, the *Norwich Courant*. In a minor government post as clerk of the franks (postfree letters granted members of Parliament), he was in a position to obtain news from members of both houses of Parliament, which he wrote as newsletters, sending them to country newspapers in several large towns. Under accusation of breach of privilege for this activity, he was dismissed from his post, and set up as a printer under the name of R. Newton. He published the first number of the *Gentleman's Magazine* under the pseudonym "Sylvanus Urban, Gent." in 1731. The magazine attained a circulation of 15,000 in a few years. One of its features was the parliamentary reports, which again brought him trouble and had to be abandoned for a time. Other famous publications by Cave were *Debates of the House of Commons, by the Hon. Achnitel Grey*, 10 vols (1745); Samuel Johnson's *Rambler*, q.v. (1750-1752); Dr. Newton's *Compleat Herbal* (1752).

CAVE, **George**, 1st VISCOUNT CAVE, English jurist: b. Cheapside, London, Feb. 23, 1856; d. Burnham-on-Sea, Somerset, March 29, 1928. After leaving Oxford he was called to the bar in 1880 becoming a barrister in 1904. In 1913 he was made counsel to the University of Oxford, in 1914 attorney general to the prince of Wales; and in 1915 he became a privy counselor and a solicitor general, and was knighted. David Lloyd George gave him the cabinet post of home secretary in 1916. When he became a viscount, in 1918, he took his seat in the House of Lords and was offered the highest judicial post in the kingdom, that of lord chancellor. He played a leading part in most of the crucial problems of his day, such as the Home Rule Bill of 1911 and 1912; the trial of Sir Roger Casement (q.v.) for treason; the police strike; and compulsory military service. Another honor he particularly enjoyed was his election to the chancellorship of Oxford University in 1925.

He was ably assisted by his wife, ANNE, (nee MATHEWS), who wrote of their travels to Zanzibar, Rhodesia, Canada, and the United States, and of their home in Richmond, Surrey.

CAVE ANIMALS. The animal life of caverns falls into three categories: (1) animals, mostly extinct, that made their dens or left their bones in caves, and in life were members of the next group; (2) animals that temporarily, but habitually, resort to caves for refuge, or sleep, or as breeding places; and (3) animals, degenerate, confined to an underground life throughout their whole existence. None of these classes include those animals making small caves for them-

selves, the burrowers; or which, like the mole and many insects, dwell in the soil; or, like the conies (hyrax), the pikas, and several sea birds, spiders, and other animals, seek safe homes among the interstices of loose rocks.

Prehistoric Cave Beasts.—The first group will require little space, as it consists of such extinct animals as the cave bear, cave lion, cave leopard, cave hyena, cave wolf, and some smaller ones that have been given these names because their bones and portraits have been found abundantly in the floors or on the walls of caverns in Europe and Africa. Indications trusted by geologists and archaeologists combine to show that these animals lived there in the latter part, at least, of the third interglacial epoch, and on through the fourth and last glacial advance, when, although central Europe was free from an icecap, an almost Arctic climate prevailed, with much rain. This is what is known as the Reindeer period, when humanity was represented by the Neanderthal race. (See *STONE AGE—Neanderthal Cave Dwellers.*) The weaker part of the fauna disappeared, but those hardy carnivora, finding food still plentiful, gradually adapted themselves by increased hairiness to the cold climate; but apparently they resorted far more than previously to the shelter of caves.

None of those mentioned above is regarded as anything but a larger, more vigorous variety of the lion, leopard, wolf, or spotted hyena except the cave bear, *Ursus spelaeus*. This beast was the most thoroughly spelaeon of all in its habits, and occupied caves before men began to do so. It was not much if any larger than the ordinary brown bear of today, and its claws were shorter and feebler. "Hence it would appear," says Henry F. Osborn, American paleontologist, "that the Neanderthals had driven out from the caves a type of bear less formidable than the existing species, but nevertheless a serious opponent to men armed with the small weapons of the Mousterian period." Probably fire and smoke were the most effective means. These bears were numerous, for game was abundant. A single cavern in western France has yielded remains of more than 800 skeletons; and from these bones and from prehistoric drawings it is possible to know this animal perfectly. With the close of the last period of partial glaciation, and the return in the early Pleistocene of the moderate climate that still continues, these and the other cave-haunting beasts disappeared, largely, no doubt, killed off by the better-armed Neolithic hunter. The great bear left no descendants, for the modern European brown bear traces its lineage to an older and smaller species, the Etruscan bear, whose bones also are occasionally exhumed from cave floors.

Caves in North America present different conditions from those of Europe. Those that have yielded animal remains, such as the Port Kennedy and Frankstown caves in Pennsylvania, and the Concord Fissure in Arkansas, "are hardly caverns" says William B. Scott, American geologist, "in the ordinary sense of the word, but rather narrow fissures, into which bones and carcasses were washed by floods." They contain a great variety of mid-Pleistocene species, at least half of which are extinct. Big Bone Lick Cave, in Kentucky, is more truly a cave, and has furnished paleontology with an immense supply of bones of recent time, including several ancient species, such as mastodons, mammoths, and the ground sloth, *Megalonyx*, and with certain traces of human pres-

ence. Caves in northern California are also rich in animal remains, illustrating the transition from glacial to modern faunas. Brazilian caverns have yielded much also; and a cavern near Last Hope Inlet, Patagonia, is noteworthy for the finding in it of the bones, and large pieces of the still hairy skin, of a great extinct sloth, *Megatherium*.

Temporary Tenants of Caves.—In modern times, as anciently, bears and other carnivora use caves as sleeping places when it is convenient, but they are exclusively resorted to by a few kinds of creatures that may properly be called cave tenants. The most characteristic of these are probably certain bats, especially such insect-eating kinds as the leaf-nosed, the horseshoe, and the true bats of the family Vespertilionidae. Caves frequented by bats usually harbor enormous colonies, and one who enters and disturbs them will find himself in the midst of a whirring multitude which taxes the powers of description. Some caves long occupied contain vast deposits of the richest possible guano, and this has been extensively utilized in some places as a fertilizer. Such artificial caverns as the deserted tombs of Egypt are filled with bats, one species of which is popularly called the tomb bat and abounds in the interior of the Great Pyramid.

Birds of two sorts are cave tenants. The most singular, probably, is the large guacharo, or oil-bird, of the family Steatornithidae, classified between the nightjars and the owls and inhabiting northern South America and the island of Trinidad. It inhabits both seaside and mountain caverns, going forth only at dusk to get its food, which is mainly fruit. "Visitors to the breeding caves," says Arthur Evans (*Birds*, 1900) "are suddenly surrounded by a circling crowd of oil-birds uttering loud croaking or rasping cries. . . . The numerous nests . . . are flat, circular masses of a clay-like substance placed on ledges or in holes." Great numbers of these birds are killed by torchlight for the sake of the oil obtained from them, which is excellent for illumination or for cooking purposes. The other birds choosing sea caves as a breeding place are swifts of the genus *Collocalia*, whose nests are placed in the depths of caves on the coasts of Ceylon, and eastward and southward to northern Australia. The best known of the many species is that which produces the edible nest of which the Chinese are so fond. Huge numbers of these swifts breed in company in dark caves, where they are associated with bats; but the bats go outside at night and the swifts by day. Such caves contain very rich deposits of guano which are exceedingly profitable to their owners.

Blind Inhabitants.—A special cave fauna exists in all parts of the world, consisting of an assemblage of animals of different classes which are blind, and in most cases eyeless. This fauna is evidently of great antiquity, since it exists most plentifully in caves, such as those of the limestone district of the South Alleghenian region, and in southern Europe, regions which are south of the Pleistocene glaciation. Within such caves, formed by the action of water, are rivers, sink-holes and deep wells, all perfectly dark, inhabited by blind amphibians, fish, crayfish, and other crustaceans, and by many kinds of insects and spiders. No vegetation exists save a few scattered molds and fungi, and all the animals are carnivorous, preying on each other. Mammoth Cave in Kentucky contains about 75 species of these blind creatures, to which 40 or 50 more may be

added from other southern caves; while several hundred kinds have been described from European caverns.

The most striking and interesting form in Mammoth Cave is the blindfish, *Amblyopsis spelaeus*. It is about four inches long, colorless and blind, the eyes being vestigial. This fish seeks the dark and shuns the light, being much disturbed by a lighted match or bright sunlight, or even by a ray of light. In well-fed adult specimens there is no external indication of an eye; but in young ones, before reaching a length of two inches, the eyes can be distinctly seen, owing to their pigment, which is lost in the adult. The optic nerve can be traced in examples under an inch in length. This will apply to the eyes of other blind fishes and blind insects, crustacea, and other blind creatures. While the sense of sight is lost, that of touch in the blindfish, as in most other cave animals, is exalted. *Amblyopsis* is provided with tactile papillae, arranged in ridges on the front and sides of the head. They are said to show extreme timidity in their movements.

A still higher type of vertebrate, two species of salamanders, have become adapted to cave life, losing their eyesight by disuse. The species of the genus *Spelerpes* frequent damp, dark situations and the entrances to caves. An allied form (*Typhlotriton spelaeus*) is distinctly a cavernicolous as distinguished from a twilight species, and has never been found outside caves. Its eyes show early stages of degeneration. It inhabits caves in southwestern Missouri, and occurs under rocks in and out of water. Still another salamander, whose eyes are the most degenerate known among amphibians, is the *Typhlomolge rathbuni*. It lives in subterranean streams, tapped by an artesian and also a surface well, near San Marcos, Texas, and in one of the caves near that town. Its remarkably long and slender legs are too weak to support its body when out of water.

The lower animals tell the same story of degeneration, total or partial atrophy of the eye, together with loss of color, and, in a more striking way, the compensation for the loss of vision by a great increase in length of the antennae and other appendages, or by the growth of long, slender tactile bristles.

The blind crayfish, *Oreonectes pellucidus*, is a common cave form. It differs from its out-of-door allies in being blind, deaf, slender-bodied, and colorless. Other blind or eyeless crustaceans are various kinds of amphipods and isopods, both aquatic and terrestrial, of which species the *Caecidotea* are the most abundant, and form the food supply of the blind crayfish.

The eyeless beetles of caves (*Anophthalmus*) have no vestige of eye or of optic nerves, while their bodies and appendages are slender. They grope their way about by means of very long tactile bristles. Other beetles, such as *Adelops*, which have retained vestiges of the outer eye, some spiders comprising an eyeless species, and others with eyes varying in size, some much reduced, spin little webs on the walls of the chambers. Among the harvestmen some (Phalangides) have extraordinarily long legs; while the Campodeidae (q.v.), a wingless insect of the Mammoth and other caves of the United States and Europe, differs from the outdoor form in its antennae and abdominal appendages, being greatly exaggerated in length. There are also mites, myriapods, primitive wingless insects (podurans), a few flies, worms, and infusorians.

Origin and History.—The blind fauna of caves, according to Alpheus S. Packard, American entomologist, is composed of the descendants of individuals which have been carried by various means into the subterranean passages, have become adapted to life in perpetual darkness, becoming isolated, and thus, as long as they are subjected to their peculiar environment, breed true to their species, and show no tendency to relapse to their originally eyed condition. The absence of the stimulus of light causes the eyes, through disuse, to undergo reduction and atrophy. With this goes, in certain forms, the loss of the optic ganglia and optic nerves.

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ERNEST INGERSOLL.

CAVE BEAR, an extinct species of European bear, *Ursus spelaeus*, closely allied to the living grizzly, but attaining a larger size. Its remains are found in bone beds of caverns, whence the name. The habits of the animal were probably not different from those of most modern bears. The cave bear of South America was a different animal (*Arctotherium*). The species found fossil in the caverns of North America include both *Arctotherium* and close relatives of the black bear, *Ursus americanus*. See also BEARS.

CAVE DWELLERS. Both ancient and modern man have utilized caves as dwelling places to a considerable extent. In North Africa today there are large colonies of troglodytes who live in underground chambers in a highly civilized area. Most dwellers who now live in caves are in areas where construction of surface homes is difficult because of lack of construction materials. Temporary shelter is often gained in caves during modern wars by people who have suffered destruction of their homes.

Most of our knowledge of ancient man has come from material preserved in caves. Probably man's first dwellings were in caverns or rock shelters that gave ready protection against both weather and animals. In Europe and Asia numerous discoveries of early man have been made in caverns, the most outstanding being the remains of Neanderthal man found in a cave in Gibraltar. The skeletal remains were encountered during excavations in the limestone in 1848. Several years later another find of Neanderthal man was made in a cave encountered in quarrying in the Rhine Valley of western Germany. Remains of man older than Neanderthal were found in the Choukoutien Cave near Peiping, China, in 1929.

Ancient man did not use caves merely as temporary shelters. In the Lascaux Cave in Dordogne, near Bordeaux, France, and in the Altamira Caverns in northern Spain, discovered in 1879, are beautiful drawings executed in color by Cro-Magnon cave dwellers over 20,000 years ago. In the Montespan Cavern in the foothills of the French Pyrenees, Norbert Casteret discovered a group of clay statues of animals carved by cave men as ancient as the artists of Lascaux. Other traces of ancient cave men have been found in Belgium, England, and southern Germany.

In the Near East, caves have been associated with both Biblical history and ancient man. The Mt. Carmel Cave near Jerusalem, excavated in

1929, contained a succession of human remains and artifacts dating from Neanderthal man to the present. In Iran and northern Iraq remains of ancient cave-dwelling men associated with implements of the Stone Age have been found in many limestone caverns. Some of the caverns, such as Pastun Cave, contained evidence they were inhabited for 7,000 years or more.

The most ancient remains of man that have been found were from a cave at Sterkfontein, South Africa. Excavations in these caves by Dr. Robert Broom, in 1948 and 1949, yielded well-preserved skulls of "ape men" probably representing the link between earliest humans and the ape-like stock that preceded them.

Near Ajanta and Ellora in Hyderabad State, India, are the celebrated cave temples. About 30 of these caves were excavated from the soft volcanic rocks by followers of Gautama Buddha about 200 B.C. Some 700 years later the caverns were enlarged and more than 30 new ones constructed by Hindus who followed the Buddhists in the region. The caves are in a cliff over 200 feet high, and are adorned with columns and frescoes. Within the caves are statues, some decorative, some religious. The statues carved by the Hindus represent the peak of their art.

Until the 20th century there were few finds made of ancient man in the caves of America. In the latter part of the 19th century many artifacts of modern and pre-Columbian Indians were uncovered in excavations in shelters and caves in the Appalachians and the Ozarks. However, no skeletal remains were found that could be considered parallel in age to those recovered in Europe.

In the late 1920's and 1930's several caves were excavated in the southwestern United States that contained a sequence of human occupation as far back as 25,000 B.C. The material recovered from these caves was well-preserved because of their extreme dryness. The oldest of the caves, at Sandia, N. Mex., contained relatively modern Pueblo material at the surface, underlain by artifacts of the Folsom culture and remains of extinct ice age animals. Still lower were more ancient deposits with remains of extinct animals including primitive horses, mastodons, and mammoths, and evidences of human occupation in the form of fireplaces and spear points. The lowest level is estimated to be 25,000 years old.

Near Las Vegas, Nev., Gypsum Cave contained a record of human settlement dating back over 10,000 years. Like Sandia Cave, the upper levels of the cave fill had remains of relatively modern Paiutes. Below this were artifacts of early Pueblos and still older Basket Makers. Still lower deposits, separated from those above by thick layers of dirt and rock fall, contained two fireplaces and implements imbedded in dung of the ground sloth. Radiocarbon dating of the dung gave an age of 8,000 to 10,000 years and clearly demonstrated that man had arrived in America before the extinction of the ice age animals. Another Nevada cave that yielded material similar to that of Gypsum was Etna Cave near Caliente.

Ventana Cave in southern Arizona has yielded many relics of human occupancy. Though more numerous than those found in Gypsum and Sandia caves they are of somewhat younger age. Other caves with remains of ancient man include Conkling's Cavern and Burnett Cave in New Mexico, the Basket Makers' caves in the Rio Grande Valley of western Texas, and several small rock shel-

ters in Oregon. It is interesting to note that although caves have yielded ample material in the form of weapons, utensils, and remains of animals that probably served as food, no skeletal remains of the ancient men who inhabited the caves have been recovered.

Prehistoric man in America not only used caves for habitation but also for burial purposes. Many shelters in the southern Appalachians, the Ozarks, and bluff shelters in the Great Plains have yielded human remains that were buried with implements, jewelry, and other artifacts. Although not so old as the remains recovered in southwestern caves, they have given important information on some pre-Columbian Indians in eastern North America. In Puerto Rico, Haiti, and Cuba a number of caves were used as dwelling places by the ancient Caribs. These caves contained a large quantity of archaeological material concerning the pre-Columbian Indians of the West Indies.

The cliff dwellers of the southwestern United States were a form of cave man. Their dwellings in Arizona, New Mexico, and Colorado were elaborate, multistoried buildings erected in large shelter caves. Behind and beneath the dwellings chambers were often cut in the soft rock to extend the living quarters, or for burials.

Modern caved dwellings are found in a belt from southern China through India, Asia Minor, the Mediterranean lands, and the West Indies. In this area are many large shelter caves in soft rock that have been converted for human use. In southern France the cave house now consists of an old caved dwelling used for storage and a recent house built in front of it. In China large cave mouths have been used by placing houses in them. In Asia Minor, in an area known as Cappadocia, are a number of conical hills that have been honeycombed by caves excavated for dwellings. Some of these excavations date back to 1900 B.C. The cave dwellings in Algeria, Tunis, and Morocco consist of shallow cavate openings made in cliffs or dug beneath the ground in which both humans and their livestock dwell. See also **CAVES OR CAVERNS; MAN, PREHISTORIC RACES OF; STONE AGE—Neanderthal Cave Dwellers.**

Consult Fewkes, J. Walter, "The Cave Dwellings of the Old and New World," *Annual Report of the Smithsonian Institution for 1910*, pp. 613-634 (Washington, D.C.); Keith, Sir Arthur, *New Discoveries Relating to the Antiquity of Man* (London 1931); Casteret, Norbert, "Lacaux Cave, Cradle of World Art," *National Geographic Magazine*, pp. 771-794, December 1948; Sellards, E. H., *Early Man in America* (Austin, Texas, 1952).

WILLIAM E. DAVIES,
National Speleological Society.

CAVE MEN are literally men who have occupied, or do occupy, caves as residences. In popular use the term most often refers to prehistoric times, when primitive men dwelt in the shelter of overhanging rocks and cavern roofs, because they had not yet learned how to build houses. This is the fact in a certain early stage of primitive culture; and it will be found treated in its proper historic place in the article **STONE AGE**. For the human occupation of caves for residence and various other purposes within historic times see **CAVE DWELLERS**.

CAVE TEMPLE, a cave used as a temple; but the name is especially applied to temples excavated in the solid rock, such as exist in considerable numbers in India. Such caves often contain striking paintings. See **CAVE DWELLERS**.

CAVEAT, kă'vê-ăt (meaning let him beware), a formal notice to a court or a public official not to perform certain acts or continue certain proceedings. The term is ordinarily used in connection with the probate of wills, or the appointment of executors or administrators for the estates of decedents. It was formerly used in connection with the obtaining of patents.

In probate proceedings, a caveat is a petition filed by an interested party to contest a will (q.v.) which has been offered for probate by the executor. Various objections to the will, such as an allegation that the testator was insane and lacked the mental capacity to dispose of his property, or that the requisite number of witnesses did not attest the will, may be made in a caveat. Where a person's name has been cut from a will, he may enter a caveat which both contests the altered will and proposes the original instrument for probate. A caveat serves to stay the probate proceedings until the facts affecting the validity of the will are determined by the court. In some states, a caveat serves only to warn the court that a will may not be entitled to probate, and it may be filed by a stranger as well as by an interested person. When a person applies to a court for appointment as administrator of the estate of a decedent, there are various procedures established by local practice for objecting to his petition, one of which is the caveat. In such a proceeding, the caveat is, in effect, an answer filed by an interested party to contest the application for appointment.

Under a statutory provision repealed in 1910, a caveat was formerly a part of the procedure for obtaining a patent. It consisted of a notice to the patent office that the person filing it (known as the caveator) claimed to be the inventor of a particular device. The utilization of this procedure entitled the caveator to be notified prior to the issuance to any other person of a patent on the device described.

CAVEAT EMPTOR, a legal maxim meaning "let the buyer beware," is found in a number of different contexts. Its most common use is in the law of sales, where it represents the opposite of the concept of "implied warranty." The law has gradually departed from the former concept and moved toward the latter, as a guiding principle in determining the rights and liabilities as between buyers and sellers of goods. Under the early common law rule, where the idea of *caveat emptor* predominated, the seller was not liable to the buyer for the bad quality of an article sold unless he himself was aware of the quality. Under the Uniform Sales Act, however, which states the generally accepted modern rule, the law implies a warranty or condition as to the quality or fitness for a particular purpose in cases where the buyer relies on the seller's skill and judgment, or where the goods are bought by description. On the other hand, where the buyer has examined the goods, the rule of *caveat emptor* still applies as to defects which such examination ought to have revealed.

In most sales, the law implies a warranty that the seller has a good title, thus making the rule of *caveat emptor* inapplicable with respect to ownership. However, in connection with judicial sales, such as execution sales and sales by receivers, executors, and guardians, the courts frequently use the phrase *caveat emptor* to indicate the risk assumed by the buyer that the goods pur-

chased are actually owned by the debtor, ward, or other person on whose behalf they are sold, applying the maxim with varying degrees of strictness.

CAVEDONI, kă-vă-dō'nê, **Giacomo**, Italian painter: b. Sassuolo, Italy, 1577; d. Bologna, 1660. Thought to have been a pupil of Annibale Carracci, he was strongly influenced by the Venetian school, particularly by the art of Lodovico Carracci and Giacomo da Bassano. The frescoes which he painted have not survived. His sense of color and his handling of light were particularly admired. His greatest works are considered to be *The Nativity* and the *Adoration of the Magi* (1612-1613) for the Church of San Paolo in Bologna; *The Virgin and St. Alo* (1614), now in the art gallery in Bologna; and *The Miracle of the Last Supper* (1621-1622) for the Church of San Salvatore in Bologna.

CAVELL, kăv'1, **Edith Louisa**, English nurse: b. Swardeston, Norfolk, England, Dec. 4, 1865; d. Brussels, executed during the German occupation of Belgium, Oct. 12, 1915. The daughter of a clergyman, she became interested in hospitals while traveling in Bavaria and in 1895 entered the London Hospital as a probationer. In 1897 she took charge of a typhoid hospital in Maidstone, Kent, and in 1906 she went to Brussels at the invitation of Dr. Antoine Depage, a distinguished surgeon, who had established a training school for Belgian nurses in a suburb of Brussels and desired to modernize the nursing system of the country. Until that time Belgian nurses had been recruited chiefly from the ranks of nuns and domestic servants—the former attending mainly to Catholics and the latter to non-Catholic patients. In 1907 Miss Cavell became matron of Depage's clinic, which developed into a large nursing organization throughout Belgium.

At the outbreak of World War I she was in England on a visit, but returned at once to Belgium and converted her institute into a hospital for wounded soldiers. Dr. Depage was called into military service to organize military hospitals in Belgium, while Miss Cavell continued her work in Brussels. During the German occupation of the city—from Aug. 20, 1914—she was permitted to remain in control of the hospital. For the first year of the war she nursed without discrimination Belgians, French, British, and Germans. During this time, with the aid of friends in Brussels, she was instrumental in conveying many of the wounded Allied soldiers—upon their recovery—across the frontier into Holland, whence they were able to rejoin their armies. She also assisted Belgians of military age to escape capture by the Germans.

Her activities were discovered by the German authorities through the agency of a Belgian traitor (who was found murdered in the street nearly a year later), and on Aug. 5, 1915, she was arrested and lodged in the military prison of St. Gilles. She was kept in solitary confinement for three weeks before the fact of her arrest became known. At the request of the British government, the United States minister in Brussels, Brand Whitlock, took up the case and addressed an inquiry (Aug. 31, 1915) to Baron von der Lancken, the chief of the political department of the German military government in Belgium. When no reply had been received after 10 days, Whitlock wrote again and was informed (Sep-

tember 12) that Miss Cavell's defense was in the hands of a Belgian advocate, Sadi Kirschen, and that no interview could be permitted. The legal adviser to the United States legation, M. de Leval, then endeavored to communicate with the prisoner, but as was usual in the procedure of such courts in Germany, neither was the prisoner allowed to see her own advocate before the trial nor was he permitted to see the documents in the case. On October 4, de Leval was informed that the trial would be held on October 7—nine weeks after the arrest.

By frankly admitting the charge brought against her, Miss Cavell had given the prosecution evidence that otherwise would have been unobtainable. According to the German military code the offense was treason and punishable by death. The trial ended on the following day (October 8) and judgment was reserved. The officials of the United States legation made the most strenuous efforts to obtain information regarding Miss Cavell's fate: at 6:20 p.m. on October 11, Hugh Gibson, the secretary, officially was informed that the decision had not yet been given. At 8 p.m., M. de Leval heard by accident that the sentence of death had been passed at 5 p.m. and that Miss Cavell was to be shot at 2 in the morning. Whitlock was ill in bed at the time, but he wrote a personal letter to Baron Moritz Ferdinand von Bissing, the military governor, while Gibson, de Leval, and the Spanish ambassador formed a deputation of appeal for mercy or at least postponement of sentence. They were dismissed about midnight and two hours later Edith Cavell fearlessly faced the firing squad. During an interview with a British chaplain she remarked, "I have seen death so often that it is not strange or fearful to me. Standing as I do in view of God and eternity, I realize that patriotism is not enough. I must have no hatred or bitterness toward anyone."

A monument to her memory has been erected in St. Martin's Place, Trafalgar Square, London, England.

CAVEN, kāv'ën, **William**, Canadian educator and minister: b. Kirkcolum, Wigtonshire, Scotland, Dec. 26, 1830; d. Toronto, Canada, Dec. 1, 1904. In 1847 he emigrated with his parents to Canada, where they settled in Dumfries township, near Galt. At 18 he entered the theological seminary of the United Presbyterian Church at London, Ontario, and was ordained in 1852. He was pastor of the United Presbyterian Church at St. Mary's, Canada West, from 1852 until 1866, when he was called to the chair of Biblical exegesis in Knox College, Toronto. In 1873 he became principal of the college and in that office (until his death) he was largely instrumental in raising funds for its new buildings. Caven contributed greatly toward the union of the various Presbyterian bodies of Canada in 1875, in which year he was moderator of the united church—a post which he held again in 1892. By his wise foresight, statesmanlike grasp of affairs, and moderating counsels, he rendered service of inestimable value in the consolidation and the upbuilding of the Presbyterian Church in Canada. From 1900 to 1904 he was president of the Pan-Presbyterian Alliance.

CAVENDISH, kāv'ën-dīsh, **LORD Frederick Charles**, second son of the 7th duke of Devonshire, English statesman: b. Eastbourne, Sussex,

England, Nov. 30, 1836; d. Dublin, Ireland, May 6, 1882. Graduating from Cambridge University in 1858, he was private secretary to Lord Granville from 1859 to 1864. He sat in Parliament as Liberal member for the north division of the West Riding of Yorkshire from 1865 until his death. After serving as private secretary to the prime minister, William E. Gladstone (1872–1873) and acting as financial secretary to the treasury (1880–1882), he succeeded W. E. Forster as chief secretary to Earl Spencer, the lord lieutenant of Ireland. On the afternoon of May 6, he and Thomas Henry Burke, an unpopular subordinate, were stabbed to death in Phoenix Park, Dublin. Eight months later, 20 "Irish Invincibles" were tried for the murder, and James Carey and two others having turned queen's evidence, five of the rest were hanged, three were sentenced to penal servitude for life, and the remaining nine were imprisoned for various terms. Carey himself disappeared; but in July news came from South Africa that he had been shot dead on a ship by an Irishman named Patrick O'Donnell. O'Donnell was brought to London, where he was tried and hanged.

CAVENDISH, George, English biographer: b. ?1500; d. ?1561. He became gentleman usher to Thomas Cardinal Wolsey about 1527 and remained in close attendance upon his great master until the latter's death, Nov. 29, 1530, after which he retired, rewarded by Henry VIII for his services, to his house at Glemsford, Suffolk, where he lived quietly with his wife, a niece of Sir Thomas More, until the close of his own life. His affection for the cardinal was most devoted, and his *Life of Cardinal Wolsey* is one of the most interesting short biographies in English. Written in 1557, it may have been read in manuscript by Shakespeare, whose view of Wolsey corresponds to that of Cavendish. Published in an unsatisfactory state in 1641, it was not until 1885 that it appeared in polished form in the *Universal Library*.

CAVENDISH, Georgiana, DUCHESS OF DEVONSHIRE (eldest daughter of John, 1st Earl Spencer), English leader of society: b. June 9, 1757; d. London, England, March 30, 1806. Mentioned by all the leading literary lights of her day and painted by the most skilled portrait painters, such as Thomas Gainsborough and Sir Joshua Reynolds, Georgiana has come down to us not only as a reigning beauty and a lady of fashion, but also as a woman of intellectual ability, fine manners, and charm. She wrote some verse herself, but was the subject of many poems by others. Among her friends were Dr. Samuel Johnson, Charles James Fox, Richard Brinsley Sheridan, Mme. Fanny d'Arblay, Horace Walpole, the prince of Wales, Charles Cornwallis, and many others.

CAVENDISH, Henry, English chemist: b. Nice (now in France), Italy, Oct. 10, 1731; d. London, England, March 10, 1810. A grandson of the 2d duke of Devonshire, after his education at Peterhouse College, Cambridge, he devoted himself to scientific research. He lived in quiet retirement, never marrying, and having no interests besides his scientific studies. He was rather eccentric and had an impediment in his speech. His first researches dealt with arsenic and in 1765 he made some notable investigations con-

cerning heats of liquefaction and vaporization which were not published until much later. He discovered the peculiar properties of hydrogen and the qualities by which it is distinguished from atmospheric air. To him we owe the important discovery of the composition of water. Karl Wilhelm Scheele, the German chemist, had already observed that, when oxygen is mixed with double the quantity of hydrogen, this mixture burns with an explosion without any visible residuum. Cavendish repeated this experiment with the accuracy for which he was distinguished. He confined both the gases in dry earthen vessels, to prevent the escape of the product of their combustion, and found that this residuum was water, the weight of which was equal to the sum of the weights of the two gases. Antoine Laurent Lavoisier confirmed this conclusion in later times. Cavendish also obtained the anhydride of nitric acid from nitrogen and oxygen, by the electric spark.

Cavendish determined to constant K in the law of gravitation $f = \frac{Kmm^1}{d^2}$, where m and m^1 are the masses of two bodies, d the distance between them and f the measure of their mutual gravitational attraction, and thus was able to determine the mean density of the earth. He found it to be 5.45 times as great as the density of water—a conclusion which differs but little from that obtained by Nevil Maskelyne in another way. The apparatus used consisted of two large fixed masses of lead and two smaller masses near these at the ends of a rod suspended by a wire at its middle. It was devised by the Rev. John Mitchell. Cavendish was a member of the Royal Society of London and in 1803 was made one of the eight foreign members of the National Institute of France. His writings consist of treatises in the *Philosophical Transactions* from 1766 to 1809. The Cavendish Physical Laboratory in the University of Cambridge is a monument to his memory.

CAVENDISH, Margaret, DUCHESS OF NEWCASTLE, English writer: b. St. John's near Colchester, Essex, England, 1624; d. London, Jan. 7, 1674. The daughter of Sir Thomas Lucas, Margaret is notable chiefly for her autobiographical record of the way in which young ladies of means were reared in the 17th century. As the youngest of a family of eight, three boys and five girls, she had ample material for her sketch. The Civil War interrupted the happy family life, and she became maid of honor (1643-1645) to Queen Henrietta Maria. While in attendance on the queen in Paris she met and married William Cavendish, later duke of Newcastle. Until the Restoration they were very poor. She wrote many poems, essays, and plays, as well as the autobiography mentioned, and a memoir of her husband. Many of her contemporaries considered her work of more value than does later critical estimate.

CAVENDISH or CANDISH, Sir Thomas, English navigator: b. Trimley St. Martin, Suffolk, England, about 1555; d. at sea off Ascension Island, June 1592. Having been in his own ship in Sir Richard Grenville's expedition to Virginia in 1585, he returned with him to England and prepared for a voyage modeled on that of Sir Francis Drake in 1577. A complete account of this adventure was recorded by a fellow-adventurer. With three small vessels he sailed from Plym-

outh in 1586 by way of Sierra Leone, Africa, where he attempted to burn the town, proceeding to South America, spending some time in Patagonia, where a harbor was named Port Desire after his own ship. He passed through the Straits of Magellan during a great storm, took and destroyed many Spanish vessels, ravaged the coasts of Chile, Peru, and New Spain, and returned by the Cape of Good Hope, having circumnavigated the globe in two years and 51 days, the shortest period in which it then had been effected. For this exploit he was knighted by Queen Elizabeth. In 1591 he set sail on a similar expedition which was unsuccessful. Accounts of his voyages may be found in Richard Hakluyt's *Principal Navigations, Voyages, and Discoveries of the English Nation* (1589).

CAVENDISH, William, DUKE OF NEWCASTLE, English general: b. 1592; d. Dec. 25, 1676. James I made him a Knight of the Bath in 1610 and in 1620 raised him to the peerage as Viscount Mansfield. Charles I made him earl of Newcastle in 1628 and appointed him in 1638 tutor and governor to his son Charles, prince of Wales (afterward Charles II), whom he taught to be a fine horseman. When the Civil War began, he embraced the royal cause and received a commission constituting him general of all the king's forces raised north of the Trent, with ample powers. Through great exertions and the expenditure of large sums from his own personal fortune, he levied a considerable army, with which, for some time, he maintained the king's cause in the north. In 1643 he obtained a complete victory over Lord Fairfax on Adwalton Moor and recovered all Yorkshire except Hull; but next year on the arrival of the Scottish Army and its junction with the parliamentary forces, he threw himself into York. Having been relieved by Prince Rupert, he was present at the Battle of Marston Moor (1644), after which he left the kingdom. His term of exile was chiefly spent in Antwerp, where he was for a long time so straitened in circumstances that he had on one occasion to pawn his wife's jewels. He returned after an absence of 16 years and was rewarded by Charles II, for his services and sufferings, with the title of duke of Newcastle. Besides plays and poems Cavendish wrote *La methode et invention nouvelle de dresser les chevaux* (1657), repeated in *A New Method . . . to Dress Horses and Work Them According to Nature* . . . (1667).

CAVENDISH, William, 1ST DUKE OF DEVONSHIRE, English statesman: b. Jan. 25, 1640; d. London, England, Aug. 18, 1707. Traveling abroad during the civil wars, at the Restoration he was elected member of Parliament for Derby in 1661. He volunteered for service in the navy and was present with the duke of York at the fight with the Dutch off Lowestoft (1665). Standing for the rights of Parliament, he served on many committees and made important speeches in the House of Commons relative to the behavior of the king's ministers. When he succeeded his father to the earldom in 1684, he took his seat in the House of Lords and was involved in a quarrel which led to his retirement while the famous house of Chatsworth (still a show place) was being built. He was secretly involved in the cause of William of Orange and when William succeeded to the English throne in 1688, at the coronation he acted as lord high steward. In

1694 he was created duke of Devonshire and marquess of Hartington.

CAVENDISH, tobacco which has been softened and pressed into quadrangular cakes and often sweetened with sirup and molasses, for chewing, so called after Thomas Cavendish. It is also called negrohead.

CAVENDISH EXPERIMENT. See CAVENDISH, HENRY.

CAVES or **CAVERNS**, natural openings within the earth, generally extending beyond the zone of light. Caves are found in many types of rock but are most common in limestone, dolomite, and gypsum, which are readily dissolved by ground water. Sandstones having considerable quantities of lime cement between their grains also give rise to solution caves. Caves in the form of lava tubes, some several miles in length, are common in extensive lava fields, particularly in the western part of North America. These caves are formed when successive lava beds from volcanic eruptions cool and solidify, trapping liquid lava that leaves open tubes when it escapes to flow to the surface. A third type of cave is found along sea or lake shores where the shoreline is cliffed or steep in slope. Waves attack zones of weakness in the face of the shore, and cut openings in the rocks which eventually develop into large cave-like passages.

Small caverns also develop along fissures, joints, or faults where slight movements of the rock give rise to small openings. Broken rock debris in the form of talus often contain large interconnected voids that are referred to as caves. One such "cave" in New Hampshire is large enough to be operated as a tourist attraction.

Origin of Solution Caves.—The origin of solution caves in limestone and related rocks is complex, and scientists are not in full accord as to the exact sequence of events that lead to the eventual formation of a cave. In all solution caves at least three related phases of development are recognized: (1) In the first phase openings are developed in the rock by solution and are integrated to form cavern passages. (2) The second phase involves the filling of these passages with clay, silt, sand, or gravel, the source of which is the surface soils or rock in the vicinity of the cave. At times these deposits of cave earth accumulate to such an extent they completely fill the primitive passages of the cave. (3) The third stage is a reverse of the second and results in the partial removal of the earth fill by streams flowing in the cave. The streams also modify and enlarge the primitive passages. Simultaneously the reopened passages receive deposits of calcite or other minerals that are carried through the rocks in solution. The deposition of these minerals on or from the walls and ceilings of passages develops beautiful stalactites, stalagmites, columns, flowstone, or other formations that are attractions in many caves opened for public inspection. During this stage the ceilings of many cavern passages are weakened by stresses exerted upon them so that they no longer support their own weight and collapse, forming large piles of rock known as breakdown.

While the three phases of development outlined are recognized by most scientists, there are two schools of thought as to the timing and po-

sition of each phase. On one hand it is believed that all three stages occur simultaneously at or near the top of the ground water in the earth. Those holding this view (known as the one-cycle theory) advocate that water descending from the surface of the earth into the ground dissolves the limestone to form cavern openings. At the same time some of the water containing large amounts of dissolved materials precipitates them on reaching the openings forming stalactites, flowstone, and other cavern formations. Earth fills also are brought in from the surface by the descending waters at the same time that the passages are being enlarged by solution. On the other hand, another group of scientists believes that each phase is distinct and separate (known as the two-cycle theory); the first phase occurs well below the top of the ground water; the second phase at or near the top of the ground water level; and the third phase in the zone between the top of the ground water and the surface of the earth.

Age of Caverns.—The age of caverns is still an unsolved problem. Many estimates have been based on the rate of growth of stalactites, fossil remains in the cavern fills, and on the rate of solution within the cavernous limestones. The figures arrived at by these methods have been of little consequence, as they are not directly tied to the origin of the cave and at best are minimum ages. Recent work in the Appalachians and Ozarks indicates caverns are closely related to erosion levels of the earth surface and that they were probably developed simultaneously. On this basis some caverns in central and eastern North America originated as far back as the Cretaceous period of geologic time with the bulk of the Appalachian caves dating from the end of the Tertiary period.

Description.—Caves have many different shapes and patterns of passages. In most caves, passages are formed primarily along joints. Faults and bedding planes are secondary in controlling the direction of passages, but often are important in developing the shape of the passages. In plan most caves are either a series of simple sinuous or subangular passages, or a complex maze of interlacing, relatively straight passages, the layout of which is similar to city blocks. The latter plan is generally found in caves developed at the point where the rocks are gently bowed upward. Passages are usually arranged vertically in levels. In caves in mountainous regions these levels are often separated more than a hundred feet. Each level of passages is relatively horizontal, both in flat-lying or steeply dipping limestones.

In size the cavern passages range from small openings which require crawling to pass through, up to giant galleries several hundred feet wide and long. Most passages, however, are relatively small with enough room to permit walking. Floors are generally formed of smooth or stream-scoured earth fills which in some caves are covered with broken fragments of fallen rock. Pits, some small with gently sloping sides, others 50 feet or more across with vertical sides over 200 feet deep, interrupt the floor in many cavern passages. In some passages deposits of calcite in the form of smooth sheets or low sinuous dams (rimstone) cover the floor. Most cavern walls are bare rock, at times with a thin covering of wet clay. In a small percentage of cavern passages beautiful deposits of minerals known as

formations occur and in many commercialized caves they are the principal tourist attraction. Those formations hanging from the ceiling are stalactites; those deposited upright on the floor are stalagmites; while those deposited in sheets or layers on the walls or floors are flowstone.

Atmospheric conditions in caves are very uniform. At the entrance, temperatures and humidity approximate surface conditions. Beyond a short zone of transition the temperature and humidity show little variation. At most times the temperature within the cave is close to the mean annual surface temperature of the region in which the cave is located. Humidity is close to 100 per cent except in some caves with abundant gypsum or other mineral deposits where humidity generally is low. In caves with passages connecting two or more surface openings, strong air circulation takes place between entrances giving rise to the term "blowing" cave. If the circulation alternates in direction at an entrance, successively blowing in and out, the phenomenon is known as a "breathing" cave. Another unique meteorological feature of some small caves, particularly lava caves, is the large accumulation of ice and freezing temperatures found in them throughout the year even though the surface temperature rises very high in summer. Several of these caves are located in desert areas in the southwestern United States and many of them are well-known in the mountains of Europe and Asia.

Location.—Caves are generally located in areas known as karst lands. Karst is the surface expression of the subterranean solution of limestone that develops caverns. Karst landscapes are pitted with sinkholes, vertical shafts, and long blind valleys which lack surface outlets. Karst soils are usually thin, and bare bands of limestone, known as *karren* or *lapiez*, form much of the surface. In karst areas there is little surface drainage as most streams flow underground through cavernous passages reaching the surface in the form of large and numerous springs.

The most famous of the karst and cavern areas in North America are in Kentucky and Tennessee. In these states plus adjacent areas of Indiana and Illinois there are over 20,000 square miles of limestone that are "karstified." Sinkholes dot much of the landscape and in places there are as many as 1,000 sinks per square mile. On the plateau surrounding Mammoth Cave in central Kentucky there are sinkholes over a mile in diameter with steep slopes over 300 feet deep that have resulted from collapse and subsequent solution of underground chambers. Passages in these caves are mainly large galleries extending for miles; gypsum is present in many of the caves. The large caves in this region, like most of the large caves in the eastern United States, are in limestones assigned in geologic age to the Mississippian system. Within this cavern area are some of America's most famous caves.

Mammoth Cave (q.v.), with over 30 miles of known passages, was discovered in 1799 and after a long history as a private commercial cave it became a national park in 1936. In the same region with Mammoth Cave are five other large commercial caves including Crystal Cave, which was owned and developed by Floyd Collins whose death in a small cave nearby attracted worldwide attention in 1925. In central Tennessee, Higginbotham Cave, which rivals Mammoth in size, is one of the largest noncommercial caves in the

United States. Wyandotte Cave in southern Indiana is one of America's oldest known commercial caves, having been discovered in 1798, after which it was operated for saltpeter until 1850 when it was opened to the public. In eastern Kentucky, near Mt. Vernon, is the Great Saltpeter Cave which, along with Mammoth Cave, was the source of much of the niter used for gunpowder during the War of 1812 and the Mexican War. It was first dug for saltpeter in 1794.

In the Appalachian Mountains there are numerous cave areas. In general, the caves are smaller but more highly decorated than those in the plateaus of Kentucky and Tennessee. The Great Appalachian Valley, extending from New Jersey to Alabama, is floored with limestone of Ordovician age and contains numerous beautiful caves, the most famous being Luray Caverns (q.v.) in Virginia, viewed by many thousands of tourists since its discovery in 1878. Weyers (Grand) Cave near Waynesboro, Va., is probably the oldest existing commercial cave in America, having been opened to the public in 1804. Madison Cave, close by, is reputed to have been opened commercially shortly before the 18th century, but for a brief period only.

In southeastern West Virginia is a region of limestones of Mississippian age that contains caverns of immense size similar to those found in Kentucky. Within this area is Organ Cave made famous by Thomas Jefferson's description of fossil bones found in it in 1799. Elsewhere, throughout both the Appalachian Mountains and plateau are many limestone valleys and ridges with thousands of small, little-known caves in them.

In the central United States, the Ozark region of southern Missouri and northern Arkansas is an important cavern region. Although there are numerous large caves and large springs in this area, other karst features are generally lacking. Other important cavern regions of the Midwest are the Black Hills of South Dakota and the Driftless area of southwestern Wisconsin. In southeastern New Mexico and western Texas are large areas of limestone, Permian and Cretaceous in age, that contain large, deep caverns, including the famous Carlsbad Caverns (q.v.), reputed to be the largest in the world. Limestones continue south through the interior of Mexico and are very cavernous, ending in Yucatán, where there are deep well-like pits, known as *cenotes*, in the karst. These *cenotes* served as sacrifice pits for the ancient Mayas. Another famous West Indian cave and karst area is northwestern Puerto Rico where the ground is so honeycombed with subterranean passages that it has been described as a "lot of cave held together by a little limestone." Similar conditions exist in western and central Cuba and in central Jamaica, which is well-known for its "Cockpit" country.

In Europe and Asia there are extensive karst and cavernous areas. Northern Italy and Yugoslavia are renowned for their large caverns and sinkholes. The Pyrenees of southern France contain the deepest cave in the world, its lower levels being over 2,000 feet below its entrance. In eastern Belgium and western Germany are caverns that are well-known because of the remains of ancient man found in them. In the Urals, the Caucasus, and other parts of the southern USSR are extensive caverns and karst, some of which are noted for the presence of radium. Other noted cavern areas are in central England, North Africa, southern China and Indochina, the

islands of the East Indies and in parts of southern and southeastern Australia.

Commercial Aspects.—Most people who visit caves tour those that have been developed for commercial purposes. Commercial caves have graded paths, elevators, and in the case of Postumia Grotto in Italy, an electric tramway to make traverse of the cave safe. Electric lights are now extensively used but formerly kerosine lanterns or pine torches were the main source of illumination. In the United States there are about 130 caves opened commercially and throughout the rest of the world there is probably an equal number. Thirteen caves in the United States have been set aside as parts of national parks or monuments including such famous ones as Carlsbad (New Mexico), Mammoth (Kentucky), Wind and Jewel (South Dakota). In America the commercial cave business is quite large with some caverns attracting as many as 500,000 visitors a year, and it is probable that over 2,000,000 persons annually visit a commercial cave.

Aside from the commercial aspects, caves have little economic value at present. However, previous to the development of modern chemical methods they were an important source of saltpeter used in the manufacture of gunpowder. In all the wars up to the Civil War in the United States, caves in the Appalachian Mountains and adjacent areas in Tennessee and Kentucky were worked extensively for saltpeter. During the Civil War a large part of the Confederate Army's gunpowder was made from saltpeter dug from caves in Virginia, West Virginia, Tennessee, Alabama, and Georgia. The saltpeter, in the form of calcium nitrate, is contained in the earth fills on the floors of caves. It was removed by leaching with water and mixing with wood ashes to produce potassium nitrate. Caverns have been considered for use as shelters in warfare but in general have been found unsuitable because of the irregular size of passages and the danger of flooding. Large deposits of sand, clay, and guano in many caves have already proved to be economically valuable.

Speleology.—The study of caves is known as speleology and those who explore caves are speleologists. In America the scientific studies of caverns and related features were not systematized until the late 1930's. In France, Germany, Austria, Italy, Yugoslavia, and England serious study has been devoted to caves since the latter part of the 19th century. In 1895 the Société de Spéléologie was founded in France and shortly thereafter similar societies were established in several European countries. In America the National Speleological Society, founded in 1939, has brought together most of those interested in caverns of the Western Hemisphere. In addition to the countries cited above, speleological societies exist in Spain, Switzerland, Bulgaria, Czechoslovakia, the USSR, and Belgium.

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WILLIAM E. DAVIES,
National Speleological Society.

CAVIANA, kă-vyă'nă, island, Brazil, in the

north mouth of the Amazon River, belonging to Pará State. Its town of Roberdello is almost exactly on the equator. About 47 miles long and 20 wide, the island is fertile and is used for some cattle raising. Pop. (1940) about 1,900.

CAVIAR or **CAVIARE**, kăv'i-är, a table delicacy prepared from the roe of the sturgeon, particularly in Russia. Astrakhan, on the Volga River, is one of the chief centers for its export. Of recent years, sturgeon caught in the United States, particularly in the Delaware River and on the north Pacific coast, has been utilized. To prepare the caviar, the ovaries are removed from the fish and are beaten to loosen the eggs, which then are put through a sieve to separate them from the tissues, are soaked in brine or other preservative, then drained and packed in oaken kegs, jars, or cans. The best Russian caviar, prepared with less salt, is difficult to preserve and is transported in ice. There are black, red, green, brown, and gray varieties varying in size from a small grain to a pea. A pressed caviar is packed in tin or glass, but is considered much inferior. Its most popular use is as an hors d'oeuvre served with vodka or other liqueurs. See also STURGEON.

CAVIGLIA, kă-vē'lyă, Enrico, Italian army officer: b. Finale Ligure, Italy, May 4, 1862; d. there, March 22, 1945. Educated at Turin Military Academy, Caviglia took part in the Eritrean War (1888-1890 and 1896-1898); served as Italian observer in the Russo-Japanese War (1904-1905); and as commander during the Tripolitan War (1911-1912). In World War I he commanded the 24th Corps which broke the Austrian lines on Bainsizza Plateau (1917), and commanded the victorious 8th Army at Vittorio Veneto (1918). Promoted general in 1919 and minister of war from January to June, 1919, he expelled Gabrielle d'Annunzio from Fiume in 1920, and in 1926 was made a field marshal. An opponent of fascism, he is thought to have plotted with Marshal Pietro Badoglio in 1943 to remove Benito Mussolini from office.

CAVITE, kă-vē'tă, province, Philippines, in the southwestern part of the island of Luzon. Bounded on the north and northwest by Manila Bay, on the northeast by Rizal Province, on the east by Laguna Province, and on the south and southeast by Batangas Province, it has an area of 498 square miles. In the south and southwest the province is mountainous; in the northwest there is a gradual elevation, forming a fertile plateau. The chief products of the lowland regions are coffee, sugarcane, fruits, and rice; in the towns of the interior hemp, cotton cloth, and sugar are manufactured; in the coastal towns the chief industries are salt manufacture and fishing. Cocoanuts also are grown. Communication with Manila and inland is by water and by road. The province includes Corregidor Island (see CORREGIDOR).

In the Spanish-American War, after the Battle of Manila Bay (1898), Cavite was occupied by United States troops, who freed it from Spanish control. The government of the province was established in 1901; later several islands were added to the province. It suffered from the Japanese invasion in World War II, was retaken by the American forces in 1945, and became part of the Republic of the Philippines in 1946. Pop. (1948) 262,550.

CAVITE (officially CITY OF CAVITE), city, Philippines, capital of the Province of Cavite on the land of Luzon. Its location on a peninsula in Manila Bay, 8 miles south of Manila, makes it a good naval base and trade center. Originally an old walled Spanish town, it was the scene of Filipino insurrections before its liberation in 1898. The naval base of Sangley Point just north of the city was seized on Jan. 2, 1942, by the Japanese in World War II and was retaken on Feb. 13, 1945, by United States forces after heavy bombardment. When the Philippines became independent in 1946, the base at Sangley Point was retained by agreement as an operational area for the United States Navy. Pop. (1948) 35,052.

CAVO-RELIEVO, kă'vô-rê-lê'vô, a system of relief in which the figures do not rise above the general surface of the material on which the carving is done. It may be regarded as sculpture in relief, of which the background has not been cleared away in the usual manner. Again, it may be considered as sculpture of which the bounding line has been marked by a groove, generally wedge shaped, that is, with a section like a V: the slope of one side being left as the boundary of the pattern or design, while the other slope disappears in the general rounding of the figures.

CAVOUR, kă-vôor', CONTE Camillo Benso di, Italian statesman: b. Turin, Italy, Aug. 10, 1810; d. there, June 6, 1861. His father was the Marchese Michele Benso di Cavour and his mother the daughter of the conte di Sellon of Geneva. Graduating from the military academy of Turin at the age of 16, with highest honors in mathematics, history, and languages, he journeyed to England to study the workings and principles of its constitution. Finding military life uncongenial, he resigned his commission in 1831 and assumed the management of his father's estates at Leri, Piedmont, which he made one of the model agricultural properties of Italy. In 1842 he returned to Turin and soon afterward published in the *Bibliothèque Universelle* of Geneva, a paper on *Considerations on the Present State and Future Prospects of Ireland*. With Conte Cesare Balbo and others he established in 1847 the journal *Il Risorgimento*, which was devoted to the cause of reform, independence, and national unity.

In 1848, Cavour became a member of the Sardinian Chamber of Deputies, and after the Battle of Novara (1849), in which the Piedmontese were defeated by the Austrians, and Charles Albert resigned in favor of his son Victor Emmanuel II, he became politically active. In 1850 he succeeded to the office of minister of commerce and agriculture, to which he later added the portfolios of the navy and of finance. He set himself to promote the internal prosperity of the country by the establishment of railways and an improved system of postal communications. A new organization was given to the military and naval forces, and the monasteries were, with certain exceptions, suppressed.

His aggressive national policy made Cavour very prominent, and in November 1852 he became premier. Not long afterward he gave a signal proof of his statesmanship by the part which he took in cementing an alliance with Great Britain and France and in making common cause with these powers and Turkey in the

Crimean War (1854-1856) against Russian aggressions. The prestige thus gained to the arms of Sardinia was no less important than that acquired by her liberal and reforming policy in civil matters. The attitude, however, thus taken by Sardinia could not fail to prove extremely offensive to the neighboring power of Austria, to whose arbitrary and repressive measures the government of Victor Emmanuel displayed itself as a standing reproach and whose supremacy in Italy was jeopardized by the aspirations of Sardinia. A collision, therefore, was inevitable, resulting in the campaign of 1859.

This conflict was foreseen by Cavour, who had made a secret agreement with the French emperor at Plombières-les-Bains, France (1858). The intimate connection formed at that time with France, who lent her powerful assistance in the prosecution of the war, was mainly due to the agency of Cavour, who was accused, on this occasion, of having purchased the assistance of Napoleon III by unduly countenancing his ambitious projects. Napoleon, however, secretly signed a treaty of peace with Austria, thus deserting Italy before the close of the war. Cavour, broken-hearted, retired to private life, but was recalled to the head of the government in 1860. In October of that year he secured the passage of a bill by the Piedmontese Parliament authorizing the government to incorporate in one union such provinces of southern Italy as should express their desire by a plebiscite. This was one of the differences which he had with Giuseppe Garibaldi who, having led his volunteers to battle, wished to be dictator of southern Italy. In 1861 all Italy was united save Rome and Venetia.

The marriage of Victor Emmanuel's daughter, Princess Clotilde, to Jérôme Bonaparte, Napoleon III's cousin, occurred in 1859, and the cession of Nice and Savoy to France at the end of that year, not without protest from Garibaldi. Another cause of dissension was over the officers, who expected to retain in the regular army the ranks which they had held as volunteers.

These differences brought some unpopularity to Cavour, but after his death his devotion to the cause of united Italy was fully recognized. See also RISORGIMENTO, THE; VICTOR EMMANUEL II.

Consult Cadogan, Edward, *The Life of Cavour* (London 1907); Thayer, W. R., *The Life and Times of Cavour*, 2 vols. (London 1911); Matter, Paul, *Cavour et l'unité italienne*, 3 vols. (Paris 1922-26); Strachey, Marjorie G., *Massini, Garibaldi and Cavour* (Harrisburg, Pa., 1938).

CAVY, kă'vī, any of several rodents of the family Caviidae, related to the capybara, pacas, and agoutis, two rather distinct subfamilies being recognized. The typical caviés (Caviinae) are characterized by their stout build, short legs, small ears, and total absence of tail. About 15 species are known, widely distributed in South America and occurring in both the highlands and the lowlands. The only species familiar to most persons living outside that continent is the domesticated guinea pig (q.v.), which is about eight inches long and owing to its harmlessness and adaptability is often kept as a pet or laboratory animal. The subfamily Dolichotinae consists of considerably larger animals with longer legs confined to southern South America. The larger and better-known Patagonian cavy, *Dolichotis australis*, is reddish in color and has the size and the habits of a hare.

Caviés of several species occur in the Plio-

cene and Pleistocene periods of South America, as is shown by numerous fossils; these extinct forms differed little from modern caviés. Caviés live in burrows of their own digging and breed twice a year, the number of young varying with the climate, but usually being one or two. The young are born in a very advanced state of development. Their eyes are open, they can run in a few hours' time, they are able to feed themselves on the next day. Their diet is vegetarian.

Consult Hudson, William Henry, *The Naturalist in La Plata* (London 1892); Lydekker, Richard, *The Royal Natural History* (London 1893-96).

CAWDOR, kô'dēr, village and parish, Scotland, in Nairnshire, five and one-half miles southwest of Nairn, three miles from a railroad junction. Cawdor Castle, nearby, on the banks of the Cawdor Burn, a tributary of the Nairn River, has a central tower, built in 1454, with battlements, drawbridge, and a moat, but is surrounded with 16th century additions. Tradition assigns it as the place where King Duncan was murdered in 1040 by Macbeth, a legend perpetuated by William Shakespeare in his tragedy *Macbeth*. Pop. (1951) 823.

CAWDOR, Thane of, a character in William Shakespeare's *Macbeth*, who does not appear upon the stage. On account of his alliance with the Northmen he was condemned to death by Duncan, king of Scotland, who bestowed his title on Macbeth, as the witches prophesied (*Macbeth*, Act I, scene 3). In describing his death it is thought that Shakespeare had reference to the execution of the earl of Essex, Robert Devereux, when he says, "Nothing in his life became him like the leaving of it."

CAWEIN, kâ-win', **Madison Julius**, American poet: b. Louisville, Ky., March 23, 1865; d. there, Dec. 8, 1914. One of America's minor poets, Cawein's verse is often exceedingly musical and displays great command of meters. Its defects are overornamentation and a too profuse employment of adjectives, but the note which he strikes is distinctive and pleasing. He is at his best in his Kentuckian poems on nature. His *Complete Poetical Works*, in five volumes, were published in 1907; *Selected Poems*, with a foreword by William Dean Howells, in 1911; and a final volume, *The Cup of Comus*, in 1915.

CAWNPORE, kôn'pôr (since 1948 officially KANPUR), city, India, capital of Cawnpore District in Uttar Pradesh, on the Ganges River, 115 miles northwest of Allahabad. Cawnpore is a major industrial center and a railroad junction for trade in grains, woolens, cotton, jute, tanneries, boots and shoes, textile products, machinery of many kinds, and a dozen other thriving industries. There is an agricultural college, a law college, and a technological institution.

As Cawnpore, it is associated in history with the Sepoy Rebellion, or Indian Mutiny, of 1857, when the native soldiers under the Raja Dundhu Panth of Bithur, called the Nana Sahib, rebelled. Gen. Sir Hugh Massy Wheeler, the commander of the European forces, defended his position for three weeks with great gallantry, but, pressed by famine and loss of men, was at length induced to surrender to the rebels on condition his party would be allowed to leave uninjured. A safe conduct was promised; but after the European troops,

with the women and children, had been embarked in boats on the Ganges, the rebels treacherously fired upon them, killed about 600, including the general, and conveyed about 200 survivors back to the city, where the men were massacred and the women and children placed in confinement. The approach of Gen. Sir Henry Havelock to Cawnpore in July aroused the brutal instincts of the Nana, who ordered his prisoners be slaughtered and their bodies thrown into the well of Cawnpore, since marked by a memorial. Pop. of the urban district (1951) 719,385.

Consult Trevelyan, Sir George Otto, *Cawnpore* (London 1865).

CAXAMARCA. See CAJAMARCA.

CAXIAS, kâ-shê'ās, the name of three cities in Brazil.

(1) CAXIAS, in northeast Maranhão State, northeastern Brazil, on the navigable Itapecuru River, 182 miles southeast of São Luis on the São Luis-Teresina Railroad. It has an airport. The chief trade is in cotton, sugar, babassu nuts, tobacco, and cereals. It is the birthplace of the poet Antonio Gonçalves Dias. Pop. (1940) 7,042.

(2) CAXIAS, now DUQUE DE CAXIAS, in Rio de Janeiro State, southeastern Brazil, near Guanabara Bay, 10 miles north-northwest of Rio on the Federal District Railway line. Manufacture of motors, processing of flax, and jute milling are main industries. There are also orange groves. Pop. (1950) 74,557.

(3) CAXIAS DO SUL, in northeastern Rio Grande do Sul State, southern Brazil, 60 miles north of Porto Alegre. Founded by Italians about 1870, it was called Caxias until 1944. Cattle and hogs are slaughtered here; it is a wine-growing center and is the terminus of a branch railroad. Agates are found nearby. Pop. (1950) 32,158.

CAXTON, kâks'tûn, **William**, first English printer: b. Tenterden, Kent, England, about 1422; d. London, 1491. In 1438 he was apprenticed to Robert Large, a mercer in London, and five years after his master's death (1441) he went to Bruges, where he went into business on his own account. About 1463 he became governor at Bruges for the English merchants settled in the Low Countries, a post in which he continued for some years. He visited Utrecht during three years and was able, with the assistance of two English envoys, to restore the old commercial relations between England and the Low Countries. In 1469 he arbitrated a dispute between English and Genoese merchants.

About 1471 Caxton entered the service of Margaret, duchess of Burgundy, sister of Edward IV of England. He had begun a translation of the popular romance entitled *Le recueil des histoires de Troie*, which he finished at Cologne in 1471. To meet the demand for the book, he learned the art of printing, probably at Cologne, and his *Recuyell of the Historiyes of Troie*, the first English printed book, appeared about 1474, having issued, it is supposed, from the press of Colard Mansion at Bruges. His *Game and Playe of the Chesse*, also a translation from French, was probably a production of the same press in 1475 and is the second English book printed. He left Bruges in 1476, returned to England, and in 1477 had a press at Westminster Abbey, where he printed the *Dictes and Sayings of the Phi-*

losophers, a translation by Earl Rivers from the French of Jean de Teonville; it was the first dated typographical work executed in England. Of the 99 works printed by Caxton, all in black letters, from six fonts of type, he edited almost every one and translated 25 of them from the French, Latin, or Dutch. The first illustrated book printed by him was *The Mirror of the World* (1481). His patrons included Edward IV, Richard III, Henry VII, Margaret Beaufort, and the chief noblemen and merchants of the day. Besides the books already mentioned, Caxton printed Geoffrey Chaucer's *Canterbury Tales*; *Troilus and Criseyde*; *Book of Fame*; John Gower's *Confessio Amantis*; works by John Lydgate; Sir Thomas Malory's *King Arthur*; *The Golden Legend*; and *The Fables of Aesop*. His books have no title pages, but are frequently provided with prologues and colophons. His types were copied so closely from the handwriting of his time that many of his books have been mistaken for manuscript. In some no punctuation is used; in others, the full point and colon only; commas are represented by a long or short upright line. In his introductions he declared that his aim was the creation of a prose style that should do for English prose something akin to what Chaucer had done for English verse. His trade device was a square block with the initials W. and C. intersected by figures representing 1474, with a border at the head and foot. Wynkyn de Worde (q.v.) was his foreman and successor. A memorial tablet is in St. Margaret's Church, Westminster, where he was buried.

CAXTONS, The, a novel by Edward G. E. Bulwer-Lytton (q.v.), published in 1850. *The Caxtons* was not only instantly popular in Britain, but 35,000 copies were sold in the United States within three years after its publication. Never before had Bulwer-Lytton written with so light a touch and so gentle a humor, and this novel has been called the most brilliant and attractive of his productions.

CAYAMBE, kă-yăm'bă, a volcanic peak in the Andes Mountains, lying directly under the equator in northern Ecuador. It rises in the shape of a beautiful and regular cone to a height of 19,160 feet. Its top is crowned with perpetual snow, and its geographical position and great elevation render it one of the most striking mountains of the world.

CAYENNE, ki-ën', city and capital of French Guiana. It is situated on the northwest coast of Cayenne Island (30 miles in circumference), which is formed by the Cayenne River, a small stream that divides into two channels before emptying into the Atlantic Ocean. The harbor is shallow, and vessels drawing over 14 feet have to anchor in the roadstead. Because of the humidity and the low and swampy character of the surrounding region, the climate is unwholesome for white people. The main highway of French Guiana connects Cayenne with Saint Laurent du Maroni, a seaport near the mouth of the Maroni River. Between 1604 and 1652 the French government sent six expeditions to Cayenne and neighboring points on the coast of Guiana. In 1654 the Dutch occupied the settlement at Cayenne, but were obliged to surrender it to a new French expedition in 1664. After the Treaty of Breda in 1667, Cayenne was attacked and damaged by the Brit-

ish, and in 1676 it again was seized by the Dutch; the latter were evicted the same year, and since then it has remained in French possession. Many of the inhabitants of Cayenne are descendants of criminals liberated from the penal settlement which was maintained in French Guiana from 1852 to 1946. Pop. (1946) 11,704.

CAYENNE PEPPER. See **CAPSICUM**.

CAYES, Les. See **AUX CAYES**.

CAYEY, kă-yě'ê, town, Puerto Rico, located in the southeastern part of the island 9 miles north-northwest of Guayama. It is 2,300 feet above sea level, and because of its cool climate it is a favorite summer resort. The town contains old barracks which date from the Spanish colonial period. Coffee, sugar, and tobacco are grown in the surrounding area. The tobacco is considered to be the finest produced in Puerto Rico, and the manufacture of cigars is the principal industry of Cayey. Pop. (1950) 18,429.

CAYLEY, kă'li, Arthur, English mathematician: b. Richmond, Surrey, Aug. 16, 1821; d. Cambridge, Jan. 26, 1895. He received his early education at Blackheath and King's College, London, passing subsequently to Trinity College, Cambridge, which elected him a fellow in 1842 and re-elected him in 1875. Called to the bar in 1849, he practiced for some years as a conveyancer, but in 1863 was appointed first Sadlerian professor of pure mathematics at Cambridge; he continued to occupy this chair until his death. He received many distinctions from universities and learned societies both at home and abroad, and in 1883 he presided over the meeting of the British Association at Southport. He seldom identified himself with movements outside his own immediate work, but took a prominent part in the movement for the higher education of women, which resulted in the foundation of Newnham College. His chief memoirs deal with differential equations, elliptic functions, and determinants. He discovered the higher curve named for him, and the principal proposition of matrices known as Cayley's Theorem. His *Elementary Treatise on Elliptic Functions* appeared in 1876, and *Single and Double Theta Functions* in 1881; a collected edition of his papers (over 900 in 13 volumes) was published between 1889 and 1898.

CAYLEY, Sir George, English inventor: b. Scarborough, Yorkshire, England, Dec. 27, 1773; d. there, Dec. 15, 1857. After education in schools at York and Nottingham, he began studies in chemistry and electricity under George C. Morgan. He made his first experiments in aeronautics at this time, and in 1796 built a tiny helicopter with windmills made of feathers which spun around a vertical axis.

From his observations of bird flight he gained an understanding of natural flight, concluding that flying was feasible for man with the aid of a gliding machine powered by a suitable engine. In 1804-1810 he engaged in aerodynamic experiments, his first published article in 1807 discussing the problem of the engine and outlining his "expansion air engine" which would operate by the expansion of hot air.

By 1809 he was able to explain the problem of flight as "to make a surface support a given weight by the application of power to the resist-

ance of air." He was the first to attempt a mathematical explanation of the basic principles of flight, his essay *On Aerial Navigation* laying the groundwork for the whole science of aerodynamics as it later developed. Articles in 1809-1810 described all his experiments and he referred in these writings to the internal-combustion engine and streamlining. In 1815 he became interested in navigable balloons. In 1837 he patented his hot-air engine, and in 1840 suggested the possibility of a twin-rotor, steam-powered helicopter.

CAYLUS, *kā-lūs'*, COMTE DE (ANNE CLAUDE PHILIPPE DE TUBIÈRES, *tū-byār'*), French archaeologist and man of letters: b. Paris, France, Oct. 31, 1692; d. there, Sept. 5, 1765. He was a son of the Comtesse de Caylus (q.v.), and after serving in the army during the War of the Spanish Succession he left the service in 1715. During 1716 he traveled in Greece and Asia Minor, making some attempts to locate ancient Troy. In 1717 he returned to Paris and began his great work *Recueil d'antiquités égyptiennes, étrusques, grecques, romaines, et gauloises* which was published in seven volumes from 1752 to 1767.

He became an active member of the Academy of Painting and Sculpture and of the Academy of Inscriptions. A friend of Jean Watteau and other contemporary figures of the art world, Caylus himself was a skillful engraver who produced many plates, copying the work of great artists and helping to preserve some early masterpieces.

Between 1749 and 1755 he made extensive experiments in the ancient method of encaustic painting, his *Mémoire* (1755) being a description of the process which he claimed to have rediscovered.

CAYLUS, COMTESSE DE (MARIE MARGUERITE LE VALOIS DE VILLETTE DE MURÇAY, *lê vâ-lwâ' dē vè-lêt' dē mūr-sā'*), French writer of memoirs: b. Poitou, France, 1673; d. Paris, April 15, 1729. Born a Protestant, she was converted to Catholicism by her aunt, Madame de Maintenon. She married the Comte de Caylus in 1686 and was left a widow in 1704. From 1707 until 1715, when Louis XIV died, she was a favorite at the French court, and her *Souvenirs*, written in later years, describes events and personalities at the court during that period.

CAYMAN ISLANDS, *kā-mān'*, a group of three islands in the British West Indies in the northwest Caribbean Sea from 150 to 200 miles west-northwest of Jamaica of which they form a dependency. Occupying an area of approximately 105 square miles, the group consists of Grand Cayman, Cayman Brac, and Little Cayman. The capital is Georgetown on Grand Cayman (pop. 1950 est., 5,721). The mean annual temperature is 80°F. and the heaviest rains occur in September and October.

The chief occupations of the islands are shark and turtle fishing, shipbuilding, rope-making, lumbering, and coconut growing. Roads suitable for motor traffic connect the settlements on the larger islands and all parts of Grand Cayman and Cayman Brac have telephone communication. A system of free and compulsory education has been established. In 1950 there were 16 schools (13 government elementary; 3 private).

The islands were discovered by Columbus on May 10, 1503, and were first named Las Tortugas because of the abundance of turtles. They were

never occupied by the Spaniards, the chief settlement being from Jamaica in the 18th century. Government is by commissioner, assisted by a 53-member Legislative Assembly of justices of peace and vestrymen. The governor of Jamaica approves all laws passed by the local legislature. Pop. (1950 est.) 7,393.

CAYUGA, *kā-yōō'gā* ("place where the locusts were taken out," or "place where the boats were taken out"), tribe of North American Indians which spoke an Iroquoian dialect. One of the original members of the Five (after 1722, Six) Nations Iroquois, the Cayuga were considered younger "brothers," "offspring," or "nephews" of the Mohawk, Onondaga, and Seneca tribes in the social and political structure established by their league. When visited by Jesuit Father Menard in 1653, their villages were located between Owasco and Cayuga lakes in Cayuga County, New York. Later villages were west of Lake Cayuga and on branches of the Susquehanna after the defeat of the Andaste in 1675. A probable offshoot of the Seneca, the Cayuga adopted remnants of such defeated tribes as the Huron, Andaste, Catawba, Delaware, and Illinois.

The basic unit of Cayuga society was the family. The families were grouped into clans, and marriage was not permitted within the same clan. Clans functioned as units in politics and religion. Cayuga villages were moved to new sites when game or fish migrated, soil in the garden became exhausted, or danger of enemy attack impended. Theirs was a typical Iroquoian economy. Maize, squash, and beans, raised by the women in communal gardens, were supplemented by meat and fish taken by the men. During the Revolution the Cayuga sided with the British. Many fled to Canada when Major General John Sullivan burned their villages in 1779. As a result of the treaties of 1789, 1795, and 1803, the Cayuga ceded all their lands to the State of New York. Since 1803 they have lived with other tribes, but have maintained a separate identity. In 1953 they resided as follows: 1,100 in Canada (approximately 1,000 on the Six Nations Reserve); 38 with the Seneca on the Cattaraugus Reservation in New York; 137 scattered on other reservations and in cities. A small number, which formerly lived in Ohio, is in Oklahoma. These were incorporated with the Seneca as Seneca Cayuga in 1937 under the Oklahoma Indian Act and are considered Seneca, although some continue to speak Cayuga. See also SIX NATIONS OF THE IROQUOIS.

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CAYUGA LAKE, *kā-ōō'gā; kā-yōō'gā; kī-ōō'gā; kū'gā*, lake, New York, on the boundary of Cayuga and Seneca counties, and extending south into Tompkins County. It is the second largest of the Finger Lakes, its area being about 66 square miles. Forty miles in length, it is the longest in the lake group, and has an average width of two miles. Its greatest depth is about 435 feet. At its north end it is connected by the Seneca River with Seneca Lake to the west. The river is partly canalized as a section of the New York State Barge Canal system and is known as the Cayuga and Seneca Canal.

The lake is of glacial origin and drains north to Lake Ontario by way of the Seneca and Oswego rivers. Its high clifflike banks have been cut by the adjoining streams. The surround-

ing area is devoted to farming, fruitgrowing, and resorts.

CAYUSE, kī-ūs', **CAILLOUX**, **CA-JOUSES**, or **KAGOUSE**, American Indian tribe belonging to the Shahaptian stock, speaking a Waiilatpuan dialect, and residing formerly around the Wallawalla, Umatilla, and Grande Ronde rivers, and from the Blue Mountains to the Deschutes River in Washington and Oregon. Spanish explorers in 1592 were the first whites to have contact with the Cayuse. Members of English trading companies came later. The first recorded contact was made by Lewis and Clark in 1806. With the opening up of the Oregon Trail to California and westward emigration for gold after 1850, the Cayuse were soon overwhelmed by white settlers. They suffered severe dislocation, and friction with whites soon began to undermine their strength. Epidemics decimated them numerically and Marcus Whitman, a missionary who established there in 1838, was blamed for these ravages. He and his entire mission were massacred in 1847.

In 1851 the Cayuse partially merged with the Nez Percés and in 1853, as the result of a treaty, they were moved to the Umatilla Reservation. In 1937 the Cayuse numbered 370; because of intermarriages this number is not reliable. Their language is nearly extinct. Horses were early bred among them as a result of their Spanish contact. This particular breed became known as the cayuse.

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CAZALES, kà-zà-lès', **Jacques Antoine Marie de**, French politician: b. Grenade, Department of Haute-Garonne, France, Feb. 1, 1758; d. Rennes, Department of Ille-et-Vilaine, Nov. 24, 1805. The son of a counsellor of the Toulouse Parliament, Cazalès served for some time in a cavalry regiment as a captain. Being chosen in 1789 a deputy of the nobility to the States-General, he became one of the most able and eloquent opponents of the French Revolution. With Mirabeau he tried to form a party uniting conservatives and liberals who wanted reform without revolution. The Royalists, however, received with ingratitude his efforts on their behalf. Upon the outbreak of the Reign of Terror in 1792 he became an émigré, fighting in an émigré army against the revolution and living in Switzerland and England. He returned to France in 1803, and Napoleon conferred on him the cross of the Legion of Honor.

CAZALIS, kà'-zà-lès', **Henry** (pseudonyms **JEAN CASELLI**; **JEAN LAHOR**), French physician and poet: b. Cormeilles-en-Parisis, Department of Seine-et-Oise, France, March 9, 1840; d. Geneva, Switzerland, July 1, 1909. In 1865, under the name Jean Caselli, he published *Chants populaires de l'Italie* and *Vita tristis, rêveries fantasques, romances sans musique*. Under his own name came *Melancholia* (1868), *Livre du néant* (1872), and *Henri Regnault, sa vie et son oeuvre* (1872). Using the name Jean Lahor, he published *L'Illusion* (1875-1893), a collection of pieces most characteristic of his work. They reveal the influence of his Oriental studies and his enthusiasm for the styles of the Parnassian school of French poets. He also wrote the remarkable *Histoire de la Littérature Hindoue*, and several treatises on medical subjects.

CAZALLA DE LA SIERRA, kâ-thâ'lyâ thâ lâ syér'râ, commune, Province of Sevilla, Spain; about 40 miles north-northeast of the city of Seville; on the south slope of the Sierra Morena in southwestern Spain. It is a food processing and agricultural center, and the chief industries are liquor distilling and manufacture of furniture and wooden boxes. There are mineral springs, and near the city are foundries for the iron and other mineral deposits lying at hand. Pop. (1941) 10,058.

CAZAMIAN, kâ-zâ-myân', **Louis**, French scholar: b. Saint-Denis, Réunion, April 2, 1877. In 1900 he graduated from the École Normale Supérieure, Paris, with a degree in English, and received his doctorate of letters in 1903. He lectured at several French universities and became professor of modern English literature and civilization at the Sorbonne in 1909. He has also lectured at the University of California, Rice Institute (Houston, Texas), Columbia University, and Wellesley College. Among his published works translated into English are *Modern England* (1911); *Carlyle* (1914); *History of English Literature* (with Émile Legouis, q.v., 1927; 8th ed., 1947); and *The Development of English Humor*, part 1 (1930); part 2 (1952).

CAZEMBE, kâ-zêm'bě, former Negro state in Africa occupying the area which later became the most northern part of Northern Province, Northern Rhodesia.

The kingdom developed as the result of conquests by a Bantu-speaking people during the 16th century. The conquering tribal divisions expanded eastward from what is now southwestern Belgian Congo to Lake Mweru, and created an empire whose sovereign bore the title muata yamvo. In the 17th century the area bounded by Lakes Tanganyika, Bangweulu, and Mweru was subjugated, and Cazembe became one of the kingdoms established; it was named for its ruler, Muata Cazembe.

Ivory trade with Arabs and Portuguese and rich copper mines enriched the kingdom. The population was divided into two distinct classes: the ruling race who had invaded and conquered the country; and the original inhabitants who were regarded as a servile class. The earliest recorded visit by a European was made by Manoel Pereira, Portuguese merchant, in 1796. Francesco de Lacerda in 1831 and David Livingstone in 1868 explored the area. About 1875 a usurper overthrew the muata and the kingdom declined rapidly thereafter.

CAZIN, kâ-zân', **Jean Charles**, French artist: b. Samer, Department of Pas-de-Calais, France, May 25, 1841; d. Le Lavandou, Department of Var, March 27, 1901. He was educated at the college in Boulogne and then went to Paris, where he studied art under Paul Le Coq de Boisbaudran. In 1868 he was appointed director of the École des Beaux-Arts and conservator of the museum at Tours. In England from 1871 to 1874, he was influenced by the Pre-Raphaelites. During 1874-1875 he was in Italy, and in 1876 he exhibited his *Le Chantier*. The following year came *La Fuite en Egypte* and in 1878 *Le Voyage de Tobie*. In 1880 he showed *Le Départ de Tobie*, *La Terre*, and *Ismaël et Agar*, the last bringing Cazin recognition as a master of landscape-religious painting.

For his *La Terre*, based on an Adam and Eve

theme, he obtained a medal of the first class. Other works are *Souvenir de fête*; *Poste de secours*; *Judith* (1883); and *La Journée faite*, in which he departs from the religious theme to portray a scene of contemporary reality. He is well known as a landscape painter. His figures are always subservient to the scene. But he has a power of idealization which gives to truth the most delicate air of poetry, a tender melancholy and charm. A wistful, hushed, sympathetic note pervades his works. He attempted to revive the art of encaustic painting. He became a member of the Legion of Honor. He also completed the decorations on the Puvis de Chavannes in the Pantheon (1898). Consult his biography by Bénédite (Paris 1901); and Marcel, *La Peinture française au XIXe siècle* (Paris 1905).

CAZORLA, kâ-thôr'lâ, Spain, a town in Andalusia and 41 miles east of the city of Jaen. It rises in the form of an amphitheatre on the slope of the Sierra de Cazorla, and is well built, though much less important and populous than in the time of the Moors, during whose wars it held an important position. It has two castles, both in good preservation. The Sierra de Cazorla is a wooded ridge round which winds the upper course of the Guadalquivir. Pop. 7,936.

CAZOT, kâ-zô', Théodore Joseph Jacques, French politician: b. Alais, Feb. 11, 1821; d. 1912. In 1848 he was active as a Republican in his home department; in 1870 he was appointed general secretary in the ministry of the interior; in 1871 elected to the National Assembly; and in 1875 was made life senator. From 1879-1882 he was Minister of Justice and was interested in bringing about a reform in the appointment of judges, but retired without passing the law he desired. In this capacity he was also active in the persecution of the Jesuits and other unauthorized assemblies. In 1883 he was president of the Court of Cassation, resigning in 1884 on account of being implicated in fraudulent dealings.

CAZOTTE, kâ-zôt, Jacques, French poet: b. Dijon, 1720; d. Sept. 25, 1792. His masterpieces are *Olivier* (1762), a poem of chivalry after the manner of Ariosto; and *The Devil in Love* (1772), a tale of wonder, still a popular favorite. He had extraordinary skill in versifying, as shown by his adding a seventh canto to Voltaire's *Civil War of Geneva* with such perfect imitation of Voltaire's style and manner as to deceive all Paris. He joined the *Illuminati* about 1775. For his opposition to the Revolution as a Royalist he was guillotined by the Revolutionary Tribunal. Consult De Nerval, *Illuminés* (Paris 1852).

CAZWINI, kâz-wē'nē, Zacharia Ben Mohammed, Arabian naturalist: b. Cazwin, Persia, 1212; d. April 7, 1283. He was descended from a family of lawyers, who derived their origin from Anas Ben Malek, a companion of Mohammed, and had settled in Cazwin, a city in Persia. From that place this author received the surname under which he has become celebrated. Of the circumstances of his life we know little more than that he was cadi of Wazith and Hillah, and died in the year of the Hegira 682 (1283 A.D.). His most im-

portant work is on natural history—*The Wonders of Nature and the Peculiarities of Creation*—of which Ideler, professor in the University of Berlin, published the chapter on the *Constellations of the Arabians*, and of which there are fragments in Bochart's *Heirozoikon*, in Ouseley's *Oriental Collections*, and in Wahl's, Jahn's and De Sacy's *Arabic Chrestomathies*. It was the object of Cazwini, like Pliny, to describe the wonders of all nature. His work contains a comprehensive view of all that had been written before him, but in so grand and original a manner that it is of higher value than most of the original works which treat of the same subjects. There is an abridged translation of it in the Persian.

CEAN-BERMUDEZ, thâ-ân' bër-moo'-dâth, Juan Agustin, Spanish art historian and painter: b. Gijon, Asturias, Sept. 17, 1749; d. Madrid, Dec. 3, 1829. He devoted himself early to the study of the fine arts, into which he was initiated by Raphael Mengs. After holding a public office at Madrid, he retired to Seville, where he founded an academy of fine arts, and occupied himself with the study of their history. He was elected a member of the royal academies of history and fine arts at Madrid, and published several valuable works connected with his favorite pursuits. His most important book, entitled *Sumario de las anti-gueda des romanas que hayan España*, appeared posthumously in 1832. He published also *Diccionario histórico de los más ilustres profesores de las bellas artes en España* (1800); *Descripción artística de Sevilla* (1804); *Diálogo sobre el arte de la pintura* (1819); *Noticias de los arquitectos y arquitectura de España* (1829).

CEANOTHUS, a genus of shrubs and small trees of the natural order *Rhamnaceae*. There are about 35 species, mostly natives of the Pacific Coast region of North America. They are characterized by serrate or entire simple leaves; small, perfect, white, purplish or blue flowers in showy clusters, which are often paniced; and three-celled drupaceous fruits, which, on drying, separate into three stones. Many of the species and their hybrids are popular ornamental shrubs, especially in mild regions, their free-blooming habit rendering them specially useful as lawn specimens. Three species, *C. americanus*, *C. ovatus* and *C. fendleri*, and some of their hybrids, are hardy in the north, but usually the hybrids must either be protected from frost or stored over winter in a plant-pit or frost-proof cellar. They succeed in almost any soil, but do best in light, well-drained loams, especially when exposed to the sun. Propagation is easily effected by seeds, cuttings or layers. *C. americanus* known as New Jersey tea and red-root, is common from Canada to the Gulf States. Its leaves are said to be used as a substitute for tea, a use to which they are reported to have been put during the American Revolutionary War.

In medicine ceanothus has not been used to any great extent. Its roots contain from 6 to 10 per cent of tannin, and have been used in domestic medicine as astringents. Owing to the close resemblance of the roots, ceanothus has been used as an adulterant for rhatany.

CEARÁ, sâ-â-râ', Brazil, a state bounded on the north and east by the Atlantic Ocean and the state of Rio Grande de Norte, on the

south by Pernambuco, and on the west by Piauí. The area is 57,371 square miles, and the population numbers 2,524,266 (1949 est.) Fortaleza, sometimes called Ceará, is the state capital and principal port; a lesser port is Camocim, 170 miles west-northwest of Fortaleza. Cities in the interior of the state include Sobral and Crato (terminus of a railroad from Fortaleza). The coast regions are sandy and unproductive, while the center is occupied by an elevated plateau which is sparsely watered and fit only for pasture. The climate is hot and dry. The most fertile area is in the upper reaches of the Jaguaribe River. Cotton, coffee, sugarcane, and fruits are cultivated. Irrigation projects have been undertaken. Portuguese occupation of the area dates from 1604, when a settlement was established near Camocim. The province of Ceará was constituted in 1822.

CEBES, sē'bēz, a Greek philosopher, of Thebes, who flourished in the 5th century B.C. A disciple and friend of Socrates and Philolaus, he is one of the interlocutors in the *Phaedo* of Plato, seeking virtue and truth. For long he was reputed to be the author of three dialogues in the Socratic style—the Phrynicus, the Hebdome, and the Pinax, or "votive tablet," a philosophical dialogue representing allegorically the temptations of this life and teaching that true learning can alone make for happiness. In spite of its pure Attic, and its truly Socratic tendency, modern criticism now assigns the work to the 2d century A.D. It was translated into all the languages of Europe, as well as Arabic, which latter version, made possible in the 9th century, is our sole record of the close of the dialogue.

CEBES OF CYZICUS, sīz'ī-kūs, a Greek philosopher, one of the Stoics, who flourished in the 2d century A.D.

CEBIDAE, sēb'ī-dē, in zoology, a family of platyrrhine monkeys. It includes all the monkeys found in the Americas with the exception of the marmoset and the tamarin. See also MONKEY.

CEBU, sā-bōō' (Visayan SUGBU, sōōg-bōō'), island, one of the Visayan Islands, in the east central part of the Philippine Islands. Tañon Strait, on the west, separates it from Negros, and Bohol Strait, on the southeast, separates it from Bohol; on the north it is bounded by the Visayan Sea, and on the east is the Camotes Sea. The island has an area of 1,707 square miles. The province of Cebu comprises that island and several others adjacent, among them Bantayan, west of the northern end of Cebu, and the Camotes group and Mactan, both off the east coast; the province has an aggregate area of 1,880 square miles and population of 1,068,078 (1939 census). The length of the island of Cebu, from northeast to southwest, is 139 miles, and the width is about 20 miles. It has a mountain system consisting of a chain running the length of the island, nearer the east than the west coast. There are six passes, the best of these being the southernmost, from Sibonga, on the east coast 28 miles southwest of the provincial capital of Cebu (q.v.), to Dumanjug, on Tañon Strait, 37 miles southwest of the capital. Other towns, both on the east coast, include Argao and Carcar. The major products of Cebu are coconuts, corn, rice, sugar, and tobacco; gold and coal are mined,

and petroleum deposits have been located. Miguel López de Legazpi (Legaspi) (q.v.) occupied the island in 1565. The Spanish authorities evacuated Cebu in 1898, and civil government was established by the United States in 1901.

CEBU, city, Philippine Islands, capital of Cebu Province, in the central part of the east coast of the island of Cebu (q.v.). It is the oldest Spanish town in the Philippines. In front of Santo Niño Church is the cross said to have been set up by Ferdinand Magellan, discoverer of the island on April 7, 1521. The city was occupied by the Japanese on April 18, 1942; it was recaptured by American troops on March 27, 1945. Pop. (1948) 167,503.

CECCHI, chāk'kē, Giovanni Maria, Italian dramatist: b. Florence, March 15, 1518; d. there, Oct. 28, 1587. The best of his 95 plays are *La Dote*; *Il Servigiale*; *La Stinava*; *La Moglie*. His religious dramas included *L'Esaltazione della Croce* (1580).

CECCO D'ASCOLI, chāk'kō dēs'kō-lē (properly FRANCESCO DEGLI STABILI), Italian poet and philosopher: b. Ascoli, about 1257; d. Florence, Sept. 16, 1327. In 1322 he was appointed professor of astrology at the University of Bologna. He wrote a commentary on the *Tractatus de Sphaera Mundi* of Johannes de Sacrobosco (q.v.) which aroused the hostility of the church. Moving to Florence, he wrote four books of *L'Acerba*, a poem of encyclopedic compass which attacked the *Divina Commedia* of Dante. The subject of the first book was astronomy with meteorology; of the second, stellar influence and physiognomy; of the third, minerals; of the fourth, sundry problems, moral and physical. This work was deemed heretical, and in consequence he was burned at the stake.

CECH, chēk, Svatopluk, Czech poet: b. Ostředek, Feb. 21, 1846; d. Prague, Feb. 23, 1908. After being educated at Prague (Praha) he practiced law, at the same time being editor in succession of several journals. A writer of national poetry, he achieved fame with such poems as *The Dreams* (1872), *The Adamites* (1874), and *Songs of Morning* (1886). His fiction included *Stories Arabesque and Humoresque* and the amusing *Candidate for Immortality* (1884).

CECIL, sēs'il, name of a historic English family. Its known ancestry begins with David Cecil (the name is variously spelled), who became a freeman of Stamford, Lincolnshire, in 1494, and subsequently mayor of that place, a member of Parliament, and sheriff of the county. Richard Cecil, his son, was the father of William Cecil, 1st Baron Burghley (see BURGHLEY), the founder of the family's greatness. From him, through successive wives the family split into two branches. THOMAS CECIL (1542-1623), 1st EARL OF EXETER and 2d BARON BURGHLEY, first of the elder line, fought in Scotland (1573) and the Low Countries (1585), and against the Spanish Armada (1588). SIR EDWARD CECIL (1572-1638), VISCOUNT WIMBLEDON, third son of the 2d Baron Burghley, commanded incompetently in the Low Countries (1596-1610) and led an expedition which negligently permitted Spanish treasure ships to find haven in Cadiz (1625). DAVID GEORGE BROWNLOW CECIL (1905-),

son and heir of the 5th Marquis of Exeter, was Olympic 400-meter hurdles champion in 1928.

ROBERT CECIL (1563?-1612), 1ST EARL OF SALISBURY and 1ST VISCOUNT CRANBORNE, first of the younger line, was the sole surviving son of the 1st Baron Burghley by his second wife. As secretary of state (1596-1608) he conducted the realm's foreign affairs. With the death of Elizabeth in 1603 he was instrumental in calling James VI of Scotland to the throne of England as James I. From 1608 he was lord treasurer.

ROBERT ARTHUR TALBOT GASCOYNE-CECIL (1830-1903), 3D MARQUIS OF SALISBURY, great British statesman, entered the House of Commons as a Conservative in 1853; after succeeding to the marquise in 1868 he was a member of the House of Lords. He served in the Cabinet as secretary for India (1866-1867 and 1874-1878) and for foreign affairs (1878), and in 1881 he was chosen leader of the peers in opposition to the Liberal administration. During 1885-1886, and again from June 1886 until 1892, he was Conservative prime minister and foreign secretary. His second term as premier was the period of the partition of Africa, royal charters being granted to the British East Africa Company (1888) for what became Kenya Colony and to the South Africa Company (1889) for what became the Rhodesias, and agreements being made (1890) with France in respect of Madagascar and with Germany respecting spheres of influence in Africa. From 1892 to 1895 he again led the opposition in the House of Lords. In 1893 the peers, by his advice, rejected William Gladstone's second bill for Home Rule for Ireland. Salisbury's third and last premiership was from 1895 until his retirement in 1902; he was also foreign secretary until 1900. During these years he had to deal with the question of Turkish atrocities in Armenia, United States intervention in the Venezuela-British Guiana boundary dispute, Russia's seizure of ports in Manchuria, a French attempt to establish a post on the Nile at Fashoda, and the South African War.

JAMES EDWARD HUBERT GASCOYNE-CECIL (1861-1947), 4TH MARQUIS OF SALISBURY, was a member of the House of Commons from 1885 until succeeding his father, the 3d marquis, in 1903, when he entered the House of Lords. He was a member of the Cabinet as lord privy seal (1903-1905) and president of the Board of Trade (1905), and in 1911 he was one of the Conservative peers who bitterly opposed the Parliament bill of David Lloyd George curtailing the powers of the House of Lords. During World War I he remained aloof from the coalition governments of Britain. He again served in the Cabinet, as lord president of the council (1922-1923) and lord privy seal (1924-1929). Subsequently, in the House of Lords, he spoke frequently in opposition to Indian constitutional reform. (EDGAR ALGERNON) ROBERT CECIL (1864-), 1ST VISCOUNT CECIL OF CHELWOOD, third son of the 3d Marquis of Salisbury, was a leading barrister before entering the House of Commons in 1906. During World War I he filled posts in the coalition governments, and after the conflict he was associated closely with President Wilson and Gen. Jan Christiaan Smuts in drafting the Covenant of the League of Nations. Under Prime Minister Stanley Baldwin he served as lord privy seal (1923-1924) and chancellor of the duchy of Lancaster (1924-1927); he resigned the latter

seat because the Cabinet failed to support the recommendation of the British delegation to the Disarmament Commission at Geneva (which he headed) that a compromise on the cruiser question should be reached with the United States. He continued to be a staunch supporter of the principles of the League of Nations, and in 1937 he was awarded the Nobel peace prize. Besides the autobiographical *A Great Experiment* (1941), he wrote *The Way of Peace* (1928) and *All the Way* (1949).

HUGH RICHARD HEATHCOTE CECIL (1869-), 1ST BARON QUICKSWOOD, fifth son of the 3d Marquis of Salisbury, was a Conservative member of the House of Commons from 1895 to 1906, and again from 1910 until 1937. A man of independent views, he frequently opposed the policies of his party. As a free trader, he was a leader among those Conservatives who fought the tariff reform policies of Joseph Chamberlain. When the Liberals sought to limit the powers of the House of Lords by enactment of the Parliament bill in 1911, he was one of its unsuccessful opponents. In the House of Commons, in 1928, he strongly supported the Anglican prayer-book proposals. From 1936 to 1944 he served as provost of Eton College. He received a barony in 1941. ROBERT ARTHUR JAMES CECIL (1893-), VISCOUNT CRANBORNE, 1ST BARON CECIL OF ESSENDON, elder son of the 4th Marquis of Salisbury, was a Conservative member of the House of Commons from 1929 until 1941, when he received a barony and was called to the House of Lords. During World War II he served the coalition government under Winston Churchill as paymaster-general (1940), secretary of state for dominion affairs (1940-1942) and for the colonies (1942), lord privy seal (1942-1943) and, once more, as secretary of state for dominion affairs (1943-1945).

LORD (EDWARD CHRISTIAN) DAVID CECIL (1902-), younger son of the 4th Marquis of Salisbury, graduated at Oxford University and subsequently lectured there. In 1948 he was appointed Goldsmith professor of English literature at New College. *The Life of Cowper* (in America, *The Stricken Deer: The Life of Cowper*, 1929) and *The Young Melbourne* (1939) are considered by many to be the finest of his books. Others included *Sir Walter Scott* (1933); *Early Victorian Novelists* (1934); *Jane Austen* (1935); *Hardy, the Novelist* (1943); *Two Quiet Lives* (1948); and *Poets and Story-tellers* (1949).

CECILIA, sê-sîl'i-â Saint, Christian virgin and martyr; her day in the Roman calendar is November 22. Her story as recounted in the *Breviarium Romanum*, represents her as a Roman lady of noble birth, a Christian from childhood, and from her early years vowed to virginity. Yet her parents gave her in marriage to a young noble, Valerianus, whom Cecilia persuaded not only to respect her vow, but also to become a Christian; and he, converted, induced also his brother, Tiburtius, and their intimate friend, Maximus, to enter Christ's fold; shortly after these three suffered martyrdom together. Cecilia now, in anticipation of the same fate or the same crown, distributed her possessions among the poor, and this becoming known to the prefect of Rome, he ordered her to be taken to her own mansion and there burned to death in the bath (*in balneo*). But the virgin, exposed to the flames for a day and a night, was found

unhurt; and, after the axe of the headsman had also failed to sever her head from her body, at last she won the double wreath of virginity and martyrdom; this was in the reign of Alexander Severus and in the pontificate of Urban I, about the year 230. Urban erected a church in her house which was called by her name. The church of Saint Cecilia is still one of the most notable churches of Rome, having been again and again repaired or reconstructed.

In this account of Saint Cecilia nothing is said of the musical accomplishments of the virgin, but legend makes much of them; hence, Saint Cecilia is the patron saint of music and musicians, and musical societies are very commonly called by her name: John Dryden's fine ode, *Alexander's Feast*; a *Song for Saint Cecilia's Day* is an imperishable monument of the Cecilian legend in English literature.

Consult Gueranger, Prosper L. P., *Sainte Cécile et la société romaine* (Paris 1873).

Another Saint Cecilia was born in Africa and suffered martyrdom by starvation under Diocletian. The Roman Catholic Church celebrates her festival on February 11.

CECILIA, a novel by Fanny Burney, published in 1782. It is a typical English novel of a century ago. The plot is simple, the story long drawn out, the style stilted, and the characters alone constitute the interest of the book, and justify Dr. Samuel Johnson's praise of Miss Burney as "a little character-monger."

CECROPIA, *sê-krô'pî-â*, a genus of plants of the order Artocarpaceae of which the best known species is the trumpetwood (*C. peltata*) of the West Indies and tropical South America. It attains a height of about 50 feet, and has a hollow stem and branches, from which musical instruments are made. Its leaves are very large, circular and peltate, and serve as food for sloths; and its flowers are small and grouped in short spikes, several of which are enclosed at first in a large bract. The wood is light and soft, and is employed by the natives in various ways, particularly for the purpose of obtaining fire by friction. Ropes are made from the inner bark, and the outer bark has astringent properties. Caoutchouc is obtained from the juice, and the buds are employed as a potherb. Certain ants utilize the hollow stem as dwellings and prove their value by repelling attacks on the trees of leaf-cutting ants.

CECROPIA MOTH, a colossal species (*Samia cecropia*) of the silkworm family Saturniidae, which ranges over eastern United States to the Rocky Mountains. The moth expands five or six inches and is brick red in color, the wings tinged with grizzly, each wing with a large crescent-shaped spot near the center, which is red and white, or white edged with red and black; on the apex of each fore wing is a large, black, eye-like spot. The caterpillar is a large green worm three to four inches in length, protected by large tubercles colored green, blue, yellow, or red. It is not uncommon on the elder, willow, apple, currant, pear, thorn, or poplar tree. At the end of summer it spins a large cocoon, open at one end, and attaches it to a branch of a tree. Allied species are found in northern Maine and Canada, Colorado and Wyoming, and on the Pacific Coast.

CECROPS, *sê'krôps*, according to Greek tradition, the founder of Athens, and the first king of Attica. He was said to have been an autochthon (sprung from the soil), and was sometimes represented as half man, half dragon. He taught the savage inhabitants religion and morals, made them acquainted with the advantages of social life, and laid the foundation of the future city of Athens, which after him was originally called Cecropia. According to later legend, he was responsible for the formation of a confederacy of 12 cities, the introduction of marriage, burial of the dead, writing and other arts. He is also said to have introduced the art of shipbuilding. He died after a reign of 50 years. By the later Greeks he was represented as having led a colony to Attica from Sais in Egypt about 1400 or 1500 B.C., but the best modern critics do not look upon this event nor on the life of Cecrops at all as historical. There is no doubt that Egypt did have a certain influence on the development of civilization in Greece, but how great this influence was, or in what manner exercised, history does not furnish sufficient data to enable us to decide. It is probable that the true Cecrops was a hero of the Pelasgian race.

CEDAR, *sê'dêr*, the name of two rivers: (1) a river rising in the extreme southern part of Minnesota, which flows southeast through the eastern part of Iowa by way of Waterloo, Vinton, and Cedar Rapids to Muscatine County, where it turns southwest and flows into the Iowa River at Columbus Junction, after a course of 329 miles; (2) a river rising in Garfield County, Nebraska, which flows 120 miles southeast into the Loup River at Fullerton, in Nance County.

CEDAR, various cone-bearing evergreen trees and their wood; also several nonconiferous trees. The most widely known are probably the cedar of Lebanon (*Cedrus libani*), the deodar, or god-tree, of India (*C. deodara*), and the African or Atlas cedar (*C. atlantica*). These are large ornamental evergreen trees with wide-spreading branches, which give them a form distinct from most other cone-bearing trees. They are sometimes planted in southern California and the Gulf states, and the last-mentioned species even as far north as Philadelphia, where it can stand the winter in sheltered situations. They are readily propagated by seeds, and thrive in well-drained, loamy soil. From ancient times their odorous, light red wood has been used for fine furniture and interior house finish. The white gum of the cedar of Lebanon, which oozes from the trunk and branches, was formerly employed in embalming, but the forests of this tree have become so much reduced that neither the resin nor the oil made from it are in commerce. The other species are most abundant, the deodar in India and the Atlas cedar in northern Africa. Their timber is widely used for fine cabinet work.

The red cedar (*Juniperus virginiana*) is a well-known very variable tree found from Canada to Florida, and westward to the Great Plains. It attains a height of about 80 feet; has a conical more or less spreading head with upright limbs; evergreen, spiny, pointed leaves, and bluish globular fruits covered with bloom. The white cedar (*Chamaecyparis thyoides*) is also a well-known American tree found in wet ground from New Hampshire to Florida. It attains a height of 70 to 80 feet; has erect spreading branches, thin and

flat pendulous twigs, fragrant green leaves, and tiny bluish-purple cones covered with bloom. The trees are highly ornamental, and, being hardy, are general favorites in the North. The wood is especially useful in moist places. The name white cedar is often applied to the arbor vitae (*Thuja occidentalis*). The yellow cedar (*Chamaecyparis nootkatensis*), a common tree on the Pacific coast from Oregon to Alaska, is valued, in cabinet work and interior house-finishing, for its light yellow wood, which takes a high polish. Like its relative mentioned above, it is often planted for ornament. In its home it often exceeds 100 feet in height. The best known nonconiferous trees that are sometimes called cedar are probably *Cedrela odorata*, the West Indian or Spanish cedar, and *Cedrela toona*, the Australian cedar. See TOON; JUNIPER.

CEDAR APPLES, fungous outgrowths upon juniper and red cedar trees. They are caused by some species of the parasitic fungus, gymnosporangium, one of the rusts. At the first they appear like warts upon the smaller branches and twigs, becoming chocolate color or brown as autumn advances, and remaining attached and unchanged until spring, when they enlarge into horn-shaped, jelly-like masses that resemble sponge. At this time they produce their abundant spores which, as the masses become dry, are blown away by the wind and, alighting on apple-trees, produce rust on the foliage and other green parts. They will not germinate upon cedar or juniper, but require an alternate host, the apple, to complete their life cycle. For methods of control see APPLE; FUNGICIDE.

CEDAR CITY, city, Utah, in Iron County; altitude 5,840 feet; it is served by the Union Pacific Railroad and has a modern airport and bus service. Situated 189 miles north of Las Vegas, Nevada, and 220 miles southwest of Salt Lake City, Utah, the city, in the heart of scenic southern Utah, serves as the gateway to Utah's national parks and monuments. Cedar Breaks National Monument and Bryce Canyon National Park are to the east and Zion National Monument and Zion National Park to the south.

Cedar City is situated in a large livestock and agricultural area. Industries include brickmaking, concrete products, coal and iron mining, feed mills, creameries, seed raising, bottling, canning, meat packing, and produce raising.

Educational and Cultural Facilities.—The city has a public library; a modern school system with high schools and gymnasium; and a hospital. There are a number of churches of the Latter-day Saints; also a Presbyterian and a Catholic Church. Cedar City is the home of the Branch Agricultural College, founded 1897, which offers the bachelor's degree, and a summer school for students interested in advanced work in higher education. The Music Arts Association fosters community renditions of music. Exhibitions of paintings and other art forms are continuous in addition to annual showings. Recreation is provided for in the operation of a municipal swimming pool, riding stables, softball games, tennis courts, golf course, skiing, boating, hunting, and fishing.

History.—Cedar City was founded in 1851 by Mormon colonists sent out by Brigham Young to discover suitable sites for colonization. They also discovered beds of iron ore. A volunteer group

of settlers skilled in mining and smelting was organized, and it was here that iron was first refined west of the Mississippi River. With the advent of the Union Pacific Railroad (1923), iron ore production in the vicinity rose materially. The vast iron deposits west of Cedar City supply ore for all the smelting plants in Utah, and also supply ore to plants in California and Colorado.

Cedar City was incorporated Feb. 18, 1868. Its form of government is by mayor, city manager, and city council. Pop. (1950) 6,106.

CEDAR CREEK, Battle of. After the battle of Fisher's Hill, Va., Sept. 22, 1864, Gen. Philip H. Sheridan followed Gen. Jubal A. Early as far as Harrisonburg, his cavalry going as far as Port Republic, Staunton, and Waynesboro, Virginia. In view of the difficulty of supplying his army so far from its base, and of other operations by which two corps of infantry and a cavalry division of his army were to be sent to the Army of the Potomac, he holding only the lower valley of the Shenandoah, Sheridan, after ordering the destruction of all mills, barns, grain, forage, and provisions of all kinds, began to withdraw down the valley on October 5, and on the 8th recrossed Tom's Brook. His rear had been so persistently followed and harassed by Confederate cavalry that he ordered his cavalry commander to whip them or be whipped. On the morning of the 9th they were engaged and routed, and 300 Confederates were taken prisoner with 11 guns and 40 wagons.

Sheridan then resumed his march, and on the 10th halted on the north bank of Cedar Creek. He was followed by a Confederate Army of about 18,000 men under General Early, who arrived at Fisher's Hill, six miles from Cedar Creek, on October 13. Sheridan departed for Washington, leaving Gen. H. G. Wright in command of the Union Army which numbered about 31,000 men. Reconnaissance parties wrongly reported that Early had retreated from Fisher's Hill. Counter Confederate reconnaissance disclosed the fact that the Union line was lightly picketed, and that infantry could cross the creek secretly by night and advance to within half a mile of the Union lines. A comprehensive plan of attack was worked out by Early, and the movement began after dark on the 18th. At dawn of October 19, covered by darkness and fog, the Confederate attack surprised the Union camp, swept everything out of it and turned captured guns upon the fugitives. Other concurrent attacks, parts of the plan, were equally successful. Wright, who had foreseen at the beginning of the attack that his position was untenable, and a change of front was necessary, withdrew to more tenable positions. Following up their advantage in spite of stiff resistance, the Confederates pressed forward, and Wright withdrew to a position north and west of Middleton, Va., where he was reinforced, and prepared to counterattack as soon as a supply of ammunition could be issued.

Sheridan, returning in haste, approved Wright's redistribution of his troops. A further attack along the entire line by Early was repulsed, and the Confederates retired to Fisher's Hill where a defensive line was thrown up beyond the reach of Union artillery. Sheridan ordered a general advance which, after a severe and obstinate fight during which parts of the Union line were repulsed, proved successful. The Confederate line was broken and the entire

army fled in disorder pursued by Union cavalry. The 24 guns taken by Early were recaptured, and he left in Sheridan's hands 23 of his own. The Union loss was 644 killed, 3,430 wounded, and 1,591 missing; of the latter 1,429 were sent as prisoners to Richmond. The Confederate loss was 320 killed, 1,540 wounded, and 1,050 missing. Early's offensive movement suspended for a time the transfer of any part of Sheridan's army to the Army of the Potomac; his defeat ended Confederate efforts to invade the North by way of the Shenandoah Valley. See also **SHENANDOAH VALLEY, MILITARY OPERATIONS IN**.

Consult *Official Records*, vol. 43 (Washington, D.C., 1881-1901); Pond, G. E., *Shenandoah Valley in 1864* (New York 1883); The Century Company, *Battles and Leaders of the Civil War*, vol. 4 (New York 1884-1887); Sheridan, P. H., *Personal Memoirs* (New York 1888); Ashby, T. A., *The Valley Campaigns* (New York 1914).

CEDAR FALLS, city, Iowa, in Black Hawk County; altitude 854 feet; on the Cedar River, and served by the Chicago Great Western; the Chicago, Rock Island and Pacific; the Illinois Central; and the Waterloo, Cedar Falls and Northern railroads. It is six miles west of Waterloo. Situated in an agricultural area, the chief manufactures include farm tools and equipment, pumps, concrete mixers, overhead doors, humidifiers, highway flares, brooms, seed-processing machinery, and stock feed.

The city has a public library, and is the seat of the Iowa State Teachers College (founded 1876), on the campus of which is a 100-foot campanile. First settled in 1844, Cedar Falls was successively incorporated as a village, a town, and, in 1865, as a city. Its government is by a mayor and council. The water-supply system is municipally owned. Pop. (1950) 14,334.

CEDAR KEYS, city, Florida, in Levy County; altitude 13 feet; on an island in a group of the same name in the Gulf of Mexico, south-southeast of the mouth of the Suwannee River; 58 miles southwest of Gainesville, connected with the mainland by a 3-mile causeway. A railway in 1860 made this town for a time a transshipping point for southern Florida, and there was a customhouse here. When the railroad was abandoned, commercial fishing, oyster and sponge gathering, and palmetto fiber brush factories became the leading industries. Pop. (1950) 900.

CEDAR KEYS, small group of islands situated approximately at longitude 83° W. latitude 29° 7' N., in the Gulf of Mexico, off the northwestern coast of the Florida peninsula, Levy County. Indian burial mounds have been excavated here. Some of the islands are government bird sanctuaries.

CEDAR LAKE, lake, Canada, in western Manitoba, northwest of Lake Winnipeg. It is 40 miles long, 32 miles broad at its widest point, and has an area of 285 square miles. The Saskatchewan River flows through it from west to east, and then pours over the Grand Rapids into Lake Winnipeg. Cedar Lake is deep enough for the largest craft except at the northwest where alluvium is deposited by the Saskatchewan. Both the surrounding mainland and the islands are well wooded with balsam, spruce, birch, poplar, tamarack, pine, and cedar, the last growing on the shores of the lake, particularly the northwest, from which the lake derives its name.

CEDAR MOUNTAIN, CEDAR RUN, or SLAUGHTER'S MOUNTAIN, Battle of. On Aug. 8, 1862, Gen. S. W. Crawford's brigade of Maj. Gen. N. P. Banks' corps marched from Culpeper Courthouse to Cedar Run to support Gen. G. D. Bayard's cavalry brigade which was being driven back by Stonewall Jackson. The latter, with the three divisions of C. S. Winder, R. S. Ewell and A. P. Hill, in all nearly 24,000 men, was advancing from Gordonsville to seize Culpeper. Next day Banks' entire corps, at Little Washington, was ordered to follow Crawford, and Gen. Franz Sigel was ordered to march his corps from Sperryville to the same point. Banks joined Crawford at Cedar Run about noon and took position on elevated ground just beyond it, covering the road to Culpeper; Crawford's brigade, and six companies of Wisconsin infantry, of Gen. G. H. Gordon's, on the right of the road, being partially hidden in woods. Gordon's brigade was held in reserve on the nearer side of the stream. Across the road on Crawford's left was Gen. J. W. Geary's brigade; Gen. Sterling G. Prince's brigade was on Geary's left, and G. S. Greene's small brigade to the left of Prince and somewhat removed. Seven batteries of artillery were distributed on the plateau slightly in advance of the infantry. Banks had about 8,000 men. Jackson, having crossed the Rapidan August 8, about noon of the 9th drove back Bayard's cavalry, and following, came under Union artillery fire and prepared for battle. Early's brigade was ordered to advance, keeping to the right and close to the Culpeper road, while Ewell led his two other brigades further to the right along the slope of Cedar Mountain. Early advanced and, coming under severe artillery fire, halted under cover of a small hill; C. S. Winder's division and three batteries came up on his left. Col. W. B. Campbell's brigade on the extreme left, then Gen. W. B. Taliaferro's, with Winder's brigade in reserve. While placing his batteries in position, Winder was mortally wounded by a piece of shell. At 5 o'clock, August 9, Banks gave the order to advance and attack. After skirmishing actions, the main line became severely engaged. The battle surged back and forth, each side advancing and suffering rebuffs. It was going hard with Early when reinforcements came up and permitted him to restore the fight and check further Union advances. Union reserves, called into action, suffered heavy loss and fell back. The Confederate advance continued. Night had now fallen, but Jackson, desiring to enter Culpeper before morning, gave immediate pursuit, and when one and one-half miles from the field was checked by Banks' rallied troops and Gen. James B. Rickett's division, which had come up from near Culpeper, followed later by Sigel. Meantime, Brig. Gen. John Pope had arrived and assumed command. Pope and Jackson confronted each other on the 10th and the 11th, but, on the night of the 11th, Jackson retreated, abandoning many of his wounded, recrossed the Rapidan and marched to the vicinity of Gordonsville. The Union loss was 1,759 killed and wounded, and 594 missing. The Confederate loss was 1,338 killed and wounded, and 31 missing.

Consult Gordon, G. H., *Army of Virginia* (Boston 1880); Ropes, J. C., *The Army under Pope* (New York 1881); The Century Company, *Battles and Leaders of the Civil War*, vol. 2 (New York 1884-1887); Allan, W., *Army of Northern Virginia in 1862* (Boston 1892); *Official Records*, vol. 12 (Washington, D.C., 1881-1901).

CEDAR MOUNTAINS (Du. CEDER BERGEN, kã'dër bër'gë), a mountain range in the province of Cape of Good Hope, Union of South Africa, located at longitude 19° E. and latitude 32° S. The highest peak is Sneeuwkop, 6,339 feet. They separate the valley of the Olifants River on the west from the valley of the Doorn River on the east. Cedar trees of gigantic size formerly covered these mountains, and still do so to a considerable extent. The mountains contain many Bosjesman (Bushman) caves.

CEDAR RAPIDS, city, Iowa, and seat of Linn County; altitude 733 feet; is situated on both sides of the Cedar River, connected by bridges, three of which connect with Municipal Island in mid-river. The city is served by the Chicago, Milwaukee, St. Paul and Pacific; the Chicago and North Western; the Chicago, Rock Island and Pacific; and the Illinois Central railroads. Local railways also provide interurban service. It is a railroad center situated 105 miles east-northeast of Des Moines. The city has a municipal airport for which extension and development is planned.

The city derives its name from the swiftly-flowing rapids of the Cedar River which furnishes valuable waterpower. Built on terraced hills, the city has wide, well-paved, and well-planted streets. Its cleanliness has earned for it the nickname, "The Parlor City."

Industries.—Cedar Rapids is the center for a large agricultural region, and has extensive wholesale trade. Grain (especially oats) processing is the main industry. Oatmeal, corn and sorghum syrup are major products. Poultry and stock feed, and meat and poultry packing are important. Machinery is manufactured here for road building, mining, milk processing, creamery, ice-cream, dairy-farming equipment, office equipment and bookkeeping systems, snow plows, pumps, furnaces, oil burners, and radio and broadcasting equipment. Other manufactures include electronic devices and pharmaceuticals. The Rock Island Railroad maintains repair shops here.

Educational and Cultural Facilities.—The city has a modern public school system with four high schools from which a high percentage of graduates enroll in neighboring colleges. The University of Iowa is 23 miles distant; the Iowa State College, and Cornell College are within easy distance, while Coe College, organized in 1881, under the auspices of the Presbyterian Church, is primarily a Cedar Rapids institution. The city has a public library, a memorial coliseum, and a Masonic library which contains one of the world's largest collections of Masonic books. The Art Association maintains an exhibit in its galleries in the public library, and the local talent of the Cedar Rapids Symphony Orchestra, and various music clubs and bands, provide creditable music programs. There is also a business school and Mount Mercy Junior College. Recreation facilities include baseball and football stadiums, tennis courts, and archery.

Among Cedar Rapids' native sons who attained distinction may be mentioned the late Grant Wood whose paintings have won wide recognition for him as America's "Painter of the Soil"; Carl Van Vechten, journalist and author; Bourke Hickenlooper, United States Senator; and Beardsley Ruml, notable as a promoter of pay-as-you-go income taxes. The largest element

of foreign descent in the city is Czechoslovak. A Czech newspaper is published here; and there is a Czech Fine Arts Society. The All-Iowa Fair is held annually at Hawkeye Downs.

History.—In 1841, a group of New England pioneers laid out the village and developed a sawmill wagon works, a woolen mill, and also opened a bank. After the first of the four major railroads reached it, progress was rapid. More settlers from the Middle Atlantic states arrived, and the place was operated in accordance with their sturdy traditions. In 1852, Bohemian and Czech immigrants settled in the vicinity and contributed largely to the development of Cedar Rapids. The present name was adopted when the town was incorporated in 1849. In 1856 it became a city; a commission form of government was adopted in 1908, with a nonpartisan election every two years. Pop. (1950) 72,296.

CEDAR WAXWING, the common American waxwing (*Bombycilla cedrorum*), a bird found throughout North America, breeding from the latitude of Kentucky northward. In most localities it is only partially migratory. It is a beautiful bird of delicate unobtrusive colors, generally ashy-brown with a purple tint on the head, the front of which, like the throat, is black. The tail feathers are tipped with yellow, and the secondaries have red waxy tips. The head is gracefully crested. Cedar waxwings spend most of the time in flocks, which wander according to the supply of food and are noteworthy for the uniformity with which all members alight or rise together. The food consists chiefly of berries when these are to be had, on account of which they have received the name of cherry birds in some sections. Nesting takes place late, when the summer is well advanced, and the rather bulky structure is usually placed in an apple or other orchard tree. The eggs are four to six in number, bluish gray, and thickly speckled. See also WAXWING.

CEDARBURG, sē'dër-bürg, city, Wisconsin, in Ozaukee County, is served by the Chicago, Milwaukee, St. Paul and Pacific Railroad. It is a trading center situated 17 miles north of Milwaukee. The city has various civic and fraternal clubs and six churches. Its light and water systems are municipally owned. First settled in 1842, the city was incorporated Oct. 28, 1921; its government is by a mayor and council. Pop. (1950) 2,810.

CEDARHURST, sē'dër-hûrst, village, New York, in Nassau County, is a residential community on the Rockaway peninsula on the south shore of Long Island, served by the Long Island Railroad. It is 17 miles east-southeast of New York City. The village was incorporated in 1910. Pop. (1950) 6,051.

CEDARTOWN, sē'dër-toun', city, Georgia, and seat of Polk County; altitude 809 feet; served by the Central of Georgia, and the Seaboard Air Line railroads, is situated 61 miles northwest of Atlanta. Its factories produce tire-cord fabric, cotton yarn, woolen cloth, slide fastener tape, cheese, vitamins, chemicals, disc-plows and harrows, paper products, furniture and other products. Cedar pine, poplar and oak abound in the district. Large high-grade iron

ore deposits are mined nearby, and limestone is present in great quantities. Big Spring flows eight million gallons of pure water daily to supply the city's entire needs. Cedartown is built on the site of an old Cherokee Indian meeting ground. It was incorporated Feb. 8, 1854. Pop. (1950) 9,470.

CEDILLA, sê-dîl'ă, a mark under the letter c used originally in Spanish, Portuguese and French to show that it is sibilant; to be sounded like the English s, not like k. It is written thus, ç.

CEDRELA, sêd'rê-lă, a genus of large timber trees, natives of the tropics of both hemispheres, giving name to the order Cedrelaceae, which is now usually included in Meliaceae. The species have evergreen, equally pinnate leaves, and small bell-shaped white flowers. *C. odorata* of Honduras and the West Indies yields bastard cedar. *C. australis* is a valuable Australian timber tree. *C. toona*, a native of Bengal, furnishes timber much like mahogany. The bark is very astringent, and has been found valuable in fevers, dysentery, etc. The flowers are used for producing a red dye.

CEFALU, chà-fă-lōō' (anc. CEPHALOEDUM, sêf-ă-lê'di-um), seaport city, Sicily, in Palermo Province, on the Tyrrhenian Sea, is situated 37 miles east of Palermo. It is the episcopal see of the province; its buildings include a fine Norman cathedral and several churches. Cefalu is named for the headland, 1,233 feet high, on which it originally stood, which headland bears on its summit ruins of an ancient Sicilian town. First historically mentioned in the 4th century A.C., the present town at the foot of the headland, dates from 1131 A.D., when the building of the cathedral, which has since been restored, was commenced. The harbor is small, capable of accommodating only a few vessels. Sea-fishing and marble quarrying are actively engaged in. Pop. (1936) 9,654.

CEHEGIN, thă-ě-hên', Spain, a commercial and industrial commune in the Province of Murcia, 34 miles west-northwest of the city of Murcia, four miles east of Caravaca, on a declivity facing the south. It has spacious streets, squares lined with substantial houses, and neat public buildings comprising a parish church, three chapels, town and courthouses, a prison, hospital, theater, cemetery, and several schools. Manufactures include paper, cloth, soap, pottery, brandy, wine and oil. There is also a trade in grain, oil, wine, fruits, wool, hemp, silk, wax, and cotton. Pop. (1940) commune 17,316; town 7,724.

CEILING, the interior overhead surface of a room or chamber usually formed of a lining of some kind affixed to the under side of joists supporting the floor above, or to rafters, generally to hide the floor. The term is equally applicable to a horizontal, curved, or other surface of any interior opposite the floor. It is also technically applied to certain specially prepared boarding or sheathing used in construction work. The word seems to have been suggested by the use of arched coverings for churches, and even for rooms, which prevailed in the Middle Ages, and were not unknown to the ancients. Ceilings

have been decorated by paintings since the earliest times. Egyptian temples and tombs were decorated on the undersides by blue paint, yellow stars, and other hieroglyphics of the heavens. The ceilings of Babylonia and Assyria often were gilded and stuccoed.

Greek roofings were decorated inside with ornaments. Arched ceilings among the Romans were known by the name camerae, or camera, the Greek origin of which seems to suggest that the arch was known to them. The camera was formed by semicircular beams of wood, at small distances from each other, over which was laid a coating of lath and plaster. In later times the camerae were frequently lined with plates of glass. They were then termed vitreae. Some ancient Greek ceilings were of decorated marble. The Romans had painted and relief decorated ceilings, as evidenced in their Pompeian baths. But the ceilings most common among the Romans were flat, the beams, as in modern times, having been covered with planks and plaster. Sometimes hollow spaces or panels were left between the planks, which were frequently covered with gold and ivory, or paintings. The arched ceilings of the Romans were commonly of brick or concrete covered with stucco, and were of three kinds: barrel vaults, groined vaults, and domes. Mosaic incrustation of curved roofing characterized the buildings of the Byzantine Empire. Good examples are Saint Mark's in Venice, and the churches at Salonika and Istanbul. Mohammedan art developed a similar form.

In the West, in the Middle Ages, the ceiling design took the form of bare rafters, which was later replaced by vaulting of stone and flat wooden ceilings. In England, the simpler forms prevailed; while in France the multiple rib vault and the elaborate fan vault developed. The wooden ceilings were decorated in the hammer-beam types of English churches and halls, which lasted until the 17th century. During the Renaissance, Italy used three types of ceiling, the smooth vault; the same with penetrations, having a flat central field and curves; and the flat paneled ceiling of wood or plaster, of which the most magnificent example is that in the Doge's palace at Venice, highly decorated with paintings by Titian, Tintoretto and Veronese. In England, during the early Renaissance, were developed plaster ceilings with curved lines, ornamented with heraldic devices and other patterns. At Coleshill, Berkshire, a ceiling by Inigo Jones (1650) shows a type which became predominant for a century: deeply sunk panels with medallions around and bands enriched with foliage and fruit in bold relief. The present type generally used is the one developed by Robert Adam. Modern ceilings are generally flat and are of plaster or wood. When the ceiling is divided into deep panels it is said to be coffered.

There are many examples of decorated ceilings in the United States, as in the dome of the National Academy of Sciences building in Washington, and in the Nebraska State Capitol.

CEILING, a meteorological and aeronautical term indicating: (1) Height above ground from which prominent objects on the ground can be seen and identified; also, the height above the ground of the base of a layer of clouds when over half of the sky is obscured. *Ceiling unlimited* denotes a cloudless or nearly cloudless sky, or a sky less than half obscured by clouds at levels

lower than an arbitrary fixed altitude. (2) *Absolute ceiling* denotes the maximum altitude at which a given aircraft can maintain horizontal flight under standard air conditions. (3) *Service ceiling* is the altitude, under standard air conditions, at which a given airplane is unable to climb faster than a small specified rate. (4) The maximum altitude at which an individual is able to maintain satisfactory muscular coordination and mental efficiency without artificial aids, such as oxygen or a pressurized cabin.

CEILING, a maximum sum fixed by government or other authority which may not be exceeded in the price charged or paid for any article or service, usually as of a certain date.

CELAKOVSKY, chě'lá-kôf-skě, František Ladislav, a Bohemian poet; b. Strakonice, Czechoslovakia, March 7, 1779; d. Prague, Aug. 5, 1852. He was destined for the pulpit, but chose pedagogy. In 1828 he became associate editor of the *Quarterly Review for the Catholic Clergy*, published by the Prague consistory. In 1834 he became editor of the *Bohemian Gazette*, and of the *Bee*, a literary journal. He also was a lecturer on Czech literature and language at the University of Prague. Having fallen into the disfavor of Emperor Nicholas I, he lost both positions. The Bohemian Society for the Propagation of Science elected him a member in 1840. Thereafter (1842-1849), he accepted a professorship of Slavic languages and literature established by the king of Prussia, for the benefit of his Polish subjects, at the University of Breslau. Changes in the political situation in 1848 brought him again a professorship at the University of Prague.

Of his numerous works, the following are the most remarkable: *Poems* (1822); *Slavic Folk Songs* (1822-1827); *Lithuanian National Songs* (1827); a metrical translation of Walter Scott's *Lady of the Lake* (1828); a translation of Augustine's *De Civitate Dei* (1829-1832), *Echoes of Russian National Songs* (1829); *Echoes of Czechic National Songs* (1839). One of his latest works was the *Popular Philosophy by the Slavic Nations in their Proverbs* (Prague 1851). After 1835 Celakovsky was engaged in a comparative study of all the Slavic dialects, the fruit of which is given in part in his additions to Joseph J. Jungmann's Czechic dictionary. As a poet he is distinguished by the grace and naiveté of his popular songs.

CELAKOVSKY, Ladislav, Bohemian botanist, son of the preceding; b. Prague, Nov. 29, 1834; d. there, Nov. 26, 1902. He was educated at Prague, where in 1860 he was appointed custodian of the botanical department of the Bohemian Museum. In 1882 he became professor of botany at the Czech University of Prague. His works are numerous and valuable. They include *Prodromus der Flora von Böhmen* (1867-1881); *Über die morphologische Bedeutung der Samenknospen* (1874); *Vergleichende Darstellung der Placenten in den Fruchtknoten der Phanerogamen* (1876); *Die Gymnospermen* (1890); *Das Reduktionsgesetz der Blüten* (1895).

CELANDINE, sěl'an-din (*Chelidonium*), a genus of herbs of the family Papaveraceae. The few species are natives of Europe, where

they are widely distributed, and whence they have spread to other parts of the world. One species is common in some of the older parts of the United States, having escaped from gardens. Common celandine (*C. majus*), which is most frequently seen, is an ill-smelling biennial or perennial plant with brittle hairy stems, pinnate leaves, small yellow flowers in umbels and slender two-valved pods. The plant has long been popular in old-fashioned gardens. It is easily grown from seed and produces abundant flowers all through summer. All parts contain an acrid yellow juice, for which the plant has been sometimes used in medicine, though it is now used practically only by the Eclectics.

CELANO, châ-lă'nô, Thomas of. See THOMAS OF CELANO.

CELASTRACEAE, sěl-ăs-tră'sě-ě, a family of polypetalous dicotyledons, consisting of shrubs and small trees, natives of southern Europe, Asia, America, Australia, etc., most of them of no great importance. They have generally acrid properties. The chief genera are *Celastrus* and *Euonymus*.

CELAYA, sâ-lă'yă, city, central Mexico, in the state of Guanajuato, altitude 5,750 feet, about 150 miles northwest of the city of Mexico. It has several fine plazas, handsome churches, among which is that of Our Lady of Carmen, a magnificent structure. Its manufactures are cotton and woolen cloth, candy, soap, candles, saddlery and other articles. The burning of its bull-ring, on Easter Sunday, 1888, caused considerable loss of life. Near Celaya are thermal springs. Celaya was founded in 1570, and in 1655 was raised to the dignity of a city by Philip IV. It was sacked by revolutionists in 1810. Pop. (1940) 22,766.

CELEBES, sěl'ě-běz; sěl'ě'běz, (Indonesian SULAWESI), one of the larger islands of the Malay Archipelago, east of Borneo (Kalimantan), west of the Molucca Islands, and south of the Philippine Islands, is part of the Republic of Indonesia. Its geographical situation is from latitude 1° 45' N. to 5° 37' S., and from longitude 118° 49' to 125° 5' E. Its area, including small integral islands, is 72,967 square miles. Celebes is singular in shape; it consists of four large peninsulas extending east, northeast, southeast, and south, divided by the Tomini, Tolo, and Bone gulfs. This unusual topography makes for countless harbors, inlets, and bays, and provides a shoreline of 3,500 miles, much of which is fringed by coral reefs and shoals dangerous to navigation. Though its northern part is cut by the equator, the island is wholly within the torrid zone. Celebes is considered to be remarkably healthful. Its natives often enjoy vigorous old age, and Occidentals live longer here than anywhere else in the Orient. Its extreme heats are tempered by the sea breezes, by the monthly rains, and by the north winds that prevail for part of the year. The east monsoon lasts from May to November; and the west during the remaining months.

The island is predominantly mountainous; two ridges form the four peninsulas. Several peaks are above 9,500 feet; one peak, Rantemario, reaches 11,286 feet. The absence of extensive deltas, and the incidence of broad grassy plains

between forests, distinguish the island from others of the archipelago. The scenery is varied and picturesque, and is greatly enhanced by magnificent tropical vegetation. There are a number of natural harbors, also several comparatively unimportant rivers the mouths of which are navigable by small craft and sampans. There are also numerous, and some large, lakes.

Geology.—The geological structure of the island varies considerably in the different regions. The central elevation is largely volcanic rock of the tertiary period surrounded by cretaceous rocks and alluvial deposits. Other regions are characterized by tourmaline quartzite, limestone, crystalline schist, shale, and sedimentary rock. The soil generally consists of a bed of vegetable mold, from 10 to 20 feet thick, on decomposing basalt. Gold is found in the valleys of the north peninsula which is often convulsed by earthquakes, and abounds in sulphur. Copper of good quality occurs at various points, and in Makassar, tin also, as pure as the famous Bangka tin. Nickel, iron, and lead also have been found in south Celebes. Diamonds are sometimes found almost at the surface of the ground, and precious stones are carried down in the sand of the torrents.

Natural History.—Much of the island is covered with forest, in parts almost primeval, although the valleys and plateaus are fertile and pasturable. Many kinds of palms abound, including the sago. Breadfruit trees and coconut palms are abundant. Among other kinds of trees are bamboo, oak, teak, cedar, and the poisonous upas. Plants requiring more careful cultivation are the coffee tree, indigo, cacao, sugarcane, cassava, and tobacco.

The island is almost entirely without the large carnivorous animals; neither has it elephants, rhinoceroses, or other animals of that type. Other indigenous animals are deer, wild hogs, which abound, together with the babirusa and the antelope. Crocodiles and snakes of several kinds are plentiful. Pouched animals and black tailless baboons also are found here. Trepan and turtle are caught in abundance; and mother-of-pearl fishing is carried on. Among domesticated animals are small but vigorous horses, buffaloes, goats, sheep, and pigs.

The People.—The main ethnic groups of the island are the Makassarese and the Buginese of the deuterio-Malay race; and the Tarajas and the Menadonese of the proto-Malay race. The maritime districts are largely inhabited by Malays; and in the harbors are many Chinese and others of mixed Malay and Battak origin who live in boats, roaming over the whole archipelago gaining a livelihood by fishing. The true aborigines are probably the dark-skinned jungle folk, a mild people having a distinct language of their own. The Buginese, and the Makassarese who are a well-built muscular people, originally inclined to Hinduism, are Mohammedans. They are good traders and excellent shipbuilders. Their praus, sea-worthy vessels, high-pooped in the style of the *Santa Maria*, are largely engaged in inter-island trade. The languages and literature of the people differ essentially from those of the islands and countries to the west. The Buginese and the Makassarese have an unusual written alphabet and languages of their own which belong to the Malayo-Javanese group. Being Mohammedans, their religious literature is mainly Arabic. The Mina-

hassese of the north of the island, a worthy and industrious people, have adopted the European style of living and the Christian religion which was first introduced during the 17th century. They have a native language, and also use the Malay and Dutch languages. The Gorontaloese of the northeastern peninsula, largely Mohammedan, are agriculturalists. The lingua franca of Celebes is Malay. The staple items of diet of the people generally are: rice, maize, and fish, supplemented at times, by some of them, by meat.

Principal Cities.—These are: (a) Makassar, population (1930) 84,855, a thriving modern city which is the southern trading center; (b) Menado, population (1930) 27,544, a northern port, and the oldest center of Christianity in Indonesia. The harbor of Makassar is quite modern, with good warehouses for ocean freight and copra. In the bazaars of Makassar are vendors of all the products of the neighboring islands as well as of Celebes itself. Among these are: bamboo canes, sandalwood, cajuput oil, nutmegs, rice, coffee, pearls, birds' nests, and trepan (*bêche de mer*).

Industries.—These include shipbuilding, fiber weaving, basket work and plaited articles, woodcarving, pottery, articles of gold and silver. Indigenous products of the island include fish, asphalt, timber, copra, spices, cotton, palm oil, coffee, sago, rice, corn, rattan, cordage fibers, tobacco, sugar, cocoa; gold, iron, nickel, petroleum, and coal are mined experimentally.

History.—The island of Celebes was first visited by the Portuguese in 1512. In 1607 the Dutch entered into commercial relations with Makassar and gradually acquired and extended control until, early in the 19th century, they made their supremacy complete. During World War II the island was overrun by the Japanese, and Menado and Makassar were occupied. The island was bombed by Americans, 1944-1945, and eventually surrendered to the Australians in 1945. With the proclamation of the independence of Indonesia, the name "Celebes" was officially discontinued and "Sulawesi," the Indonesian name for the island, was restored. From early 1946 until late 1949, the administration of the Republic was interrupted because the Dutch, with the support of the Australian occupation army, reoccupied the island. During the four years of their occupation the Dutch launched unsuccessful attempts to liquidate the independence movement, but with the major retirement of the Dutch in 1949, the Indonesian administration was again restored in Celebes.

Educational Activities.—The introduction of general compulsory education is one of the aims of the new Republic. Already the island has an educational system which provides primary schools for several hundred thousand pupils. There are government-maintained secondary schools, and many unregulated schools of various kinds throughout the various provinces. Special teacher-training courses are held in Makassar, and an anti-illiteracy movement is actively carried on for adults. Government-supported educational institutions on the college level will be inaugurated.

Government.—In addition to the governor, there is a provincial representative Assembly whose members are elected. The island is divided into two residences, South Sulawesi, and North Sulawesi. The government is bipartisan, and periodical elections are held. The popula-



Above: Typical village, Celebes. Dense settlement is confined to the coast.

CELEBES

Right: Students in a government literacy school, Makassar.

Below: Newly transplanted rice seedlings on a farm in the Manado district. The land is submerged during most of the growing season.

(Above and right) K. Peizer and Bob Laubach from Black Star; (below) Ava Hamilton





Above: Street in Makassar. The fez is the badge of the Moslems, who number about 90 per cent of the capital city's population.
 Below: Passaar Street, the main business thoroughfare in Makassar.

Ewing Galloway



tion of the island is (1930) 3,781,554. See also INDONESIA, REPUBLIC OF.

Consult Williams, Maynard Owen, "Celebes: New Man's Land of the Indies," *National Geographic Magazine*, pp. 51-82, July 1940; id., "Life and Death in Toradjaland," *National Geographic Magazine*, pp. 65-80, July 1940; Collins, G. E. P., "Seafarers of South Celebes," *National Geographic Magazine*, pp. 53-78, January 1945; Embassy of Indonesia, *Republic of Indonesia* (Washington 1951).

CELERES, a body of horsemen traditionally said to have been introduced by Romulus, and to have numbered 300, consisting of citizens rich enough to furnish a horse. They are also described as subdivided into three centuries, under the names of Ramnes, Titienses and Luceres. The number of the centuries of the Celeres is said to have been raised to six by Tarquinius Priscus, this being the origin of the equites or knights, who in after times formed a separate class of citizens.

CELERIAC, sê-lêr'î-ăk, a plant, *Apium graveolens rapaceum*, of the parsley family, and a horticultural variety of celery. It is highly prized as a vegetable in Europe but is little grown in America. Unlike celery, the plant has a very thick, fleshy root. This is used in flavoring stews or it may be boiled or used in salads.

CELERY, a biennial or annual herb (*Apium graveolens*) of the family Umbelliferae. It is a native of Europe, Asia and Africa, in the older civilized parts of which it was cultivated prior to the Christian Era. In nature the plants are commonly found in moist ground, where they attain a height of from 6 to 15 inches. They have numerous leaf stalks, odd-pinnate leaves and branching leafy flower stalks two to three feet tall, bearing many small umbels of small white flowers which give place to small seeds (fruits). Cultivated celery does not differ in general characteristics from the wild plant, but by cultivation its leaf stalks (the part desired for the table) have been made more solid, less stringy and more agreeably flavored. In many instances, too, they have been lengthened or increased in number and made to form more compact plants. Celery is usually eaten raw with salt, but often it is used as a cooked vegetable, and its leaves, roots or ground seeds are frequently used for flavoring.

Commercial production of celery in the United States began in the vicinity of Kalamazoo, Mich. in the 1880's.¹ Its rapid popular acceptance led the extension of its production into some 15 important producing states. Celery production ranks about 15th in terms of acreage, 6th in terms of production, and 4th in terms of proper value among the 25 more important commercial truck crops. Marketings generally exceed 25 million crates (averaging about 65 pounds each).

Production has become highly specialized among producers, and in the major producing areas the operations have become highly mechanized. Most of the production is grown in muck soil areas in Florida and California and a few of the Great Lake states, although a considerable volume also is grown in sandy soils in New Jersey, Florida and some other states. Celery produc-

tion requires large quantities of fertilizer and humus.

Production begins with the very careful preparation of seed beds and the fields into which the plants subsequently are transferred. About four or five weeks after the seeds are sown in the seed beds, the plants are ready for transplanting into the fields, after which about 90 days are required for the plants to attain marketable size. During this growing period the crop is cultivated meticulously, sprayed with insecticides and fungicides and irrigated frequently.

The typical harvesting operation involves the cutting of the plants immediately below the surface of the ground, stripping the stalk of loose and undesirable outer branches, placing the stalks in field boxes, and cutting the tops to a stalk of uniform length. In the more important areas the celery is then hauled immediately to a packing house where the stalks are washed, sorted, and packed according to uniform sizes in shipping containers, cooled with an ice water bath the temperature of which is approximately 32°F., and loaded into refrigerator cars or trucks for shipment to market. At each stage of the production and preparation for market the work is performed by trained and carefully supervised workers. Emphasis is placed upon care, speed, and refrigeration to preserve the fresh qualities of this perishable food. Meanwhile successive plantings are proceeding a few days apart so as to maintain as even a movement of celery to market as possible.

Preferences exist in the various consuming markets for particular sizes of stalks and types of celery, depending primarily upon localized customs of housewives, restaurants and institutions with respect to methods of serving. Market price premiums and discounts vary between consuming markets, depending upon customary methods of serving and the relative supplies of appropriate varieties and sizes of stalks suitable for such customs in the local market. Consequently the marketing of celery from the shipping point becomes somewhat complex.

Prior to the early 1940's essentially all celery was blanched by "earthing up" as the celery approached marketable size, or by other means of shading the stalks with boards, paper, or straw. The blanching effect also was obtained by spacing the stalks closely in the rows so that the heavy foliage would provide the shading necessary for blanching. Later the rapid expansion and consumer acceptance of the higher-yielding Pascal type of celery permitted producers in some of the important producing areas to discontinue blanching. While consumers in some market areas were slow to accept the green Pascal type, this was largely overcome and permitted a major shift in production to the higher-yielding Pascal type. Together with improved farming practices, this contributed to a very rapid increase in average yields per acre: to from two to four times the yields obtained approximately 10 years before.

Consult Beattie, W. R., *Celery Growing*, Farmers' Bulletin No. 1269, U.S. Dept. of Agriculture (Washington 1944).

CELESTIAL MECHANICS, the branch of astronomy and applied mathematics which develops all the consequences of the law of gravitation. Its origin goes back to 1687, when Sir Isaac Newton in his *Principia* estab-

¹ Beattie, W. R., "Celery Growing," U.S. Department of Agriculture Farmers' Bulletin No. 1269, Washington, D.C., revised October, 1944.

lished the dynamical principle causing the planetary motions: "two particles of matter attract each other with a force proportional to the product of their masses and inversely proportional to the square of the distance between them." This accounted for the three facts that Johannes Kepler had laboriously deduced empirically: (1) that planetary orbits are elliptical with the Sun at one of the foci; (2) that the planets move in such a way that the radius vector describes equal areas in equal times; and (3) that the squares of the times of revolution of the planets around the Sun are proportional to the cubes of their distances from that body.

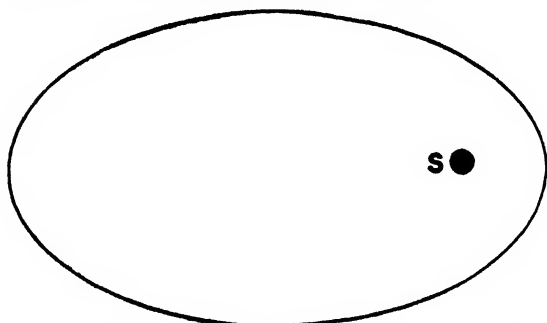


FIG. 1.—The Sun (S) in the focus of a cometary elliptic orbit.

When in the course of the 20th century it was found that the motion of binary stars conforms to the same rules, it became evident that the dynamical principle prevailing in the solar system applied as well to the most remote stars so that Newton's rules of motion rightly deserve the name of *law of universal gravitation*.

Perturbations.—If the planets' motions depended solely on the Sun's attraction, their orbits would be perfectly elliptical. But from the universality of the law of gravitation it results that the planets and their satellites also attract each other, and this produces small deviations from

on the return of the planets to similar configurations: they are the *periodic inequalities*. Marquis Pierre Simon de Laplace was the first to show that, while most of the orbital elements undergo both kinds of perturbations, the major axis of the orbit remains unchanged, if we consider only the first powers of the perturbing forces; this gives a very high approximation in the solar system where the solar mass is so dominant. He also showed that over long periods of many centuries the various elements will fluctuate between rather narrow limits: for instance, the ellipticity of any planetary orbit will never change so much that the orbit can become a parabola, nor will the inclination of the Earth's orbit on its equator continue to diminish, as it does at present, so

S●

FIG. 3.—Crosses mark the two possible locations of Trojans relatively to the Sun (S) and Jupiter (J).

far that both planes would ultimately coincide, thereby removing all seasonal effects. Laplace also found the large perturbation, caused by the mutual attraction of the two biggest planets, Jupiter and Saturn, which recurs after a little more than nine centuries.

Masses.—Since perturbations depend on the masses of the planets, they have been used inversely to determine the masses of the planets having no satellites. When a planet has a satellite, the mass is known as soon as the period of revolution of the satellite, as well as its distance from the planet, is measured. But when, as in the case of Mercury, Venus and, more recently, Pluto, there is no satellite, this direct and accurate method is not applicable. Only the per-

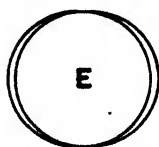


FIG. 4.—Tidal bulge produced in the oceans by the action of the Moon (M) on the Earth (E).

FIG. 2.—Neptune's (N) attraction perturbing the motion of Uranus (U).

purely elliptical motion, which are called *perturbations*.

There is no general rigorous solution of the mathematical problem of perturbations even in the case of three bodies. But the masses of the planets are small compared with that of the Sun, and their orbits do not differ much from circles. This makes approximate solutions possible although the analysis is extremely complicated and delicate.

Perturbations are divided into two groups. Some alter the shape and position of the orbits very slowly but continuously: they are the *secular inequalities*. Others recur at intervals depending

turbations caused by these planets on the other bodies of the solar system can give a clue as to their mass.

In the first half of the 19th century planetary perturbations were used not only for finding masses but even to predict the existence of an unknown planet. In the course of his exploration of the sky, Sir William Herschel in 1781 discovered a new planet which was subsequently called Uranus. After some years this planet showed unexplained deviations from the predicted position. Two investigators, John Couch Adams in England and Urbain Jean Joseph Leverrier in France, independently concluded in 1846 that the deviations in the motion of Uranus could be accounted for by assuming the existence of a more

distant planet, whose position in the sky could be roughly predicted. The unknown object was promptly found close to the foreseen location and was named Neptune. Its discovery constitutes one of the greatest triumphs of the theory of gravitation.

The Lunar Problem.—The problem of the Moon's motion is one of the most arduous in celestial mechanics. In this case, while the Moon gravitates mainly under the attraction of the Earth, the Sun's action enters as a perturbing force, but its amount is such that many of the approximations that could be made in the case of the smaller attractions of the planets cannot be applied here. In spite of the enormous amount of work that has been devoted to the problem, even the latest tables predicting the course of the Moon show discrepancies, which, although small, introduce errors of several seconds in the prediction of total eclipses of the Sun. The cause of the discordance is probably not to be sought in an inadequacy of the theory of gravitation. There are indications that the Earth's rotation around its axis undergoes small irregularities. A slow lengthening of the day in the course of the centuries may well account for the fact that the Moon tends to run ahead of its computed position.

The law of gravitation has given the explanation of many other peculiarities in the solar system.

Precession.—Already in the 2d century B.C. the Greek astronomer Hipparchus had noted an apparent increase in the longitude of all stars. Newton showed that this resulted from a gradual shift in the position of the Earth's axis produced by the action of the Moon and of the Sun on the equatorial bulge of the not perfectly spherical Earth. Although the Moon is so much less massive than the Sun, it is so much nearer that its influence accounts for nearly two thirds of the yearly change of 50 seconds of arc.

Tides.—The attraction of the Moon and, to a lesser extent, of the Sun on the waters of the ocean produces the phenomenon of the tides. The crest of the tide follows the Moon as the Earth rotates and appears as a periodic rising and falling of the ocean level twice a day. The height of the tide varies considerably with the changing distance of the Moon and its location far from or near to the Earth's Equator. In the course of the monthly changes in lunar configuration the Sun's influence may increase or decrease the Moon's effect. At full or new Moon the tidal force of the Sun is directly added to that of the Moon, causing high spring tides, while at first or last quarter the forces counteract each other with the result that the so-called neap tides are less than half as high as the former. In reality the crest of the tide lags behind the time when the Moon is in the meridian. This lag varies with local circumstances such as the shape of the coastline, the depth of the water, and ocean currents. For every port, the average value of this lag, called the "establishment of the port," has been determined; this makes it possible to predict the high and low tides without any particular difficulty for any point on the coast.

The Asteroid Group.—Several peculiarities in the distribution of the large number of small planets or asteroids covering the wide belt of space between the orbits of Mars and Jupiter have been accounted for by the law of gravita-

tion. The vicinity of Jupiter to these small bodies causes large perturbations in their motion and has produced in the course of time gaps in their distribution in regions where the period of revolution around the Sun is in a simple ratio to that of Jupiter.

A special case of the three-body problem, namely that of a planet making an equilateral triangle with Jupiter and the Sun in the plane of Jupiter's orbit, had been shown by Joseph Louis Lagrange in the 18th century to be a possible solution. A planet near such a location may oscillate around the theoretical position, but when the initial deviation is not too large the effect of the perturbations will be to make the body swing back and forth around the apex of the triangle, thus producing what is designated as a stable solution. A dozen asteroids moving according to this theoretically foreseen possibility have been found, some preceding and others following Jupiter, corresponding to the two equilateral-triangle solutions. They are called the Trojans because they have been given names of the heroes of the Trojan War to distinguish them from the other asteroids which are designated by feminine names.

The law of gravitation has found further application in explaining the gaps in the rings of Saturn and also the oblateness of the rotating planets.

Stellar Systems.—While, thus far, most of the features of the solar system have been accounted for by the law of gravitation, in recent years mathematical astronomers have considered the consequences of that law in the case of stellar systems. They have studied the stability of globular clusters, those large groups of stars, gravitating not around a central dominating mass, but each one moving under the influence of all the others in the group. They have studied also the still larger systems which are of the same nature as our galaxy and can be seen on photographs of the sky as spiral-like formation. A new mathematical approach was necessary to solve such problems: the individual bodies are not followed, but the probability of the behavior of any of them is considered. This leads to interesting conclusions not only in regard to the stability but also concerning the duration of these stellar systems and therefore the time scale of the universe. See also biographies of the scientists mentioned.

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GEORGE A. VAN BIESBROECK,
Professor, University of Chicago, Yerkes Observatory, Williams Bay, Wisconsin.

CELESTIAL SPHERE, an imaginary sphere (of which the apparent vault of the sky forms half) upon which all celestial bodies appear projected. Its radius must be infinitely great, so that—no matter where he may be—the observer is always at the center. For astronomical and navigational purposes, several systems of imaginary circles lie upon it, permitting the determination of the position of all celestial bodies through their spherical coordinates. See also **COLURE**.

CELESTINA, La (in full *TRAGICOMEDIA DE CALISTO Y MELIBEIA*), one of the parent sources of modern realism, was the work of Fernando de Rojas (q.v.), sometime mayor of Salamanca, whose title to the authorship of a recent Spanish scholarship has been established to the exclusion of other claimants. Originally appearing at Burgos in 1499, the 21 acts of this loose drama, or dialogued novel, provide a singularly vivid and realistic picture of the night life of a Spanish city of the Renaissance; its more unsavory features are conveyed with a touch that is absolutely modern in its directness. The story, however, of the amours of Calisto and Melibeia, as promoted by the activities of the bawd Celestina, is less happy, because of the blight of long passages of scholastic dialectic and of pseudoclassical erudition which rest heavily upon it. *La Celestina* was the point of departure of the Spanish picaresque or rogue novel, which in turn became a dominant factor in the development of the English novel.

CELESTINE I, sěl'ēs-tin; sê-lēs'tin, saint and pope: b. in Campania, Italy; d. July 26, 432; r. 422-432. He was a Roman and zealous in maintaining the faith and rights of the church and the dignity of his office. In this he was aided by Galla Placidia, mother of the boy emperor, Valentinian III. He was a close friend of St. Augustine and defended him against the Semi-Pelagians (see *CASSIANUS*). Among other heresies and schisms which vexed his reign were those of Donatism, Manichaeism, Nestorianism, Novatianism, and Pelagianism (qq.v.). Nestorius, bishop of Constantinople, whom he ordered to retract in writing or to be excommunicated, was condemned by the Third General Council at Ephesus in 431.

Celestine's last official act, perhaps the most far-reaching of his pontificate, was to send St. Patrick in 432 to preach Christianity in Ireland after the death of Palladius, whom he had sent thither as missionary-bishop in 431. Sixteen of Celestine's letters on a variety of subjects and a fragment of his discourse on Nestorianism are extant.

His feast is kept on April 6 in the Roman Catholic Church, and on April 8 in the Greek Church, where he is greatly honored for his condemnation of Nestorius.

Consult Duchesne, L., ed., *Liber Pontificalis*, vol. 1, p. 230 (Paris 1886).

CELESTINE II (GUIDO DEL CASTELLO), pope: b. Città di Castello, Umbria, Italy; d. March 8, 1144; r. 1143-1144. A pupil of Abélard, he is described as a learned priest and an upright man. As pope he lifted the interdict imposed on France by Innocent II, in his dispute with Louis VII over the bishopric of Bourges.

CELESTINE II (TEOBALDO BOCCADIPICORA), antipope: r. 1124. Elected successor to Callistus II, he resigned within a few hours to prevent a schism, after the powerful faction of the Frangipani had invaded the conclave and compelled the proclamation of its candidate, Lambert Cardinal Scannabecchi, who then ruled as Honorius II.

CELESTINE III (GIACINTO BOBONE), pope: b. about 1106; d. Rome, Italy, Jan. 8, 1198; r. 1191-1198. For 47 years he had been a cardinal deacon, when he was elected pope in

his 85th year. He was ordained priest and consecrated bishop at once. Celestine crowned Henry VI of Germany emperor and used great forbearance, whether from fear or charity, with this cruel and predatory monarch, but he excommunicated Duke Leopold of Austria, who, at Henry's instigation, had seized and imprisoned Richard I of England on that monarch's return from the Third Crusade. Celestine confirmed the new military Order of Teutonic Knights (q.v.). Against Alfonso IX of León and Philip II of France he insisted on strict interpretation of the church's laws on marriage.

CELESTINE IV (GOFREDO CASTIGLIONI), pope: b. Milan, Italy; d. Nov. 10, 1241; r. 1241. A Cistercian and the nephew of Urban III, he was elected during the papal warfare with Frederick II, but died after a pontificate of only 15 days. There was a suspicion that he had been poisoned.

CELESTINE V (PIETRO DI MURRONE), saint and pope: b. Isernia, Italy, 1215; d. Fumone, May 19, 1296; r. 1294. A Neapolitan of humble parentage, he became a Benedictine at 17 and later was ordained priest. He withdrew to the wilderness and lived as a hermit in prayer, fasting, and mortification. So many others followed his example that, before his death, there were 36 monasteries with 600 religious bearing the papal name Celestines (q.v.). Fatigued by governing his followers, he again withdrew from men and to a wilder fastness.

In a scene unparalleled in ecclesiastical history, Pietro was besieged in his mountainous retreat by a multitude of monks, led by messengers who brought news that he had been chosen pope by a conclave which, divided for 27 months, at last had united on his election. In tears he protested his elevation, but eventually obeyed what seemed to be the voice of God. In the five months of his reign Celestine made many serious mistakes, due chiefly to his inexperience in ecclesiastical polity. He scattered privileges and posts lavishly, often bestowing the same place on several suitors, and thus confused the affairs of the Curia. Incompetent, ill at ease, impatient of time taken from pious exercises for political matters, Celestine abdicated. His successor, Boniface VIII, fearing a schism, kept him a prisoner. After two abortive attempts to escape to his cave, he died in his cell in the castle of Fumone 17 months after his abdication.

Celestine's day is May 19 in the Roman calendar, where he is styled not simply St. Celestine, but St. Peter Celestine.

Consult Duchesne, Louis, ed., *Liber Pontificalis*, vol. 2, pp. 467 ff. (Paris 1892).

CELESTINES, sěl'ēs-tinz; monastic order of the Roman Catholic Church founded by Pietro di Murrone (later Pope Celestine V, q.v.), who organized it as a religious community under his personal rule. A decade later Urban IV approved it and attached it to the Benedictines (1264). First called Hermits of St. Damian, the community assumed the name of Celestines after Pietro's elevation to the papal throne. The order became moribund late in the 18th century and no longer exists.

CELESTITE, sěl'ēs-tit, a native form of strontium sulphate, SrSO_4 , crystallizing in the

orthorhombic system, and also occurring in fibrous and radiated forms. The crystals resemble those of barite, and are usually tabular or prismatic. They have a hardness of from 3 to 3.5, and a specific gravity of 3.96.

Celestite is commonly white with a vitreous lustre, but it also occurs with a pronounced bluish tinge, from which circumstance it received its name. When found in quantity it is a useful source of strontium. Fine crystals of it occur in the limestone about Lake Erie. Other important localities are in Sicily, Hungary, England, Canada, West Virginia, and California. Varieties containing large amounts of calcium or of barium are called calciocelstite and barytocelestite respectively; and the mineral itself is often called celestine.

CELIBACY, the state of being unmarried, but not implying necessarily either virginity or chastity. In Judaism marriage was a divine ordinance and sterility was a mark of divine displeasure. Celibacy, either temporary or perpetual, for certain classes in the service of temples (as the emasculated *Galli* of the cult of Attis), virginity (as the Vestal Virgins in Rome), and continence before performing certain religious ceremonies were practiced in several pagan cults. Those who embraced the ascetic way of life, as in Buddhism, abandoned their families to live as celibates. Likewise in Christianity monastic rules imposed celibacy on all members of ascetic communities. Celibacy and a vow of chastity are still required for all full-fledged members of monastic and religious orders in the Roman Catholic and in the Eastern churches. But the ecclesiastical laws concerning the secular clergy in matter of celibacy are at variance in the Christian churches of today. In the Roman Catholic Latin Church all members of the clergy in major orders, beginning with sub-deacons, are bound by a strict law of celibacy and chastity. The Eastern Orthodox churches impose the obligation of celibacy only on bishops but not on the lower clergy. This rule is followed also by the Uniates, that is, by Catholics of the eastern rites united with Rome. In the Protestant churches there are no restrictions: the same discipline regulates marriages of both ministers and laymen.

Historical Development.—There is perhaps no other ecclesiastical institution which has given rise to so many controversies about its origin, its value and its observance. As to its origin there have been three different theories: (1) that sacerdotal celibacy was a divine institution; (2) that it was established by the Apostles; (3) that it was introduced by a later ecclesiastical law. Its value has been challenged and defended in ancient and modern times according to different estimations of the disadvantages and the advantages of a celibate clergy. Its observance met for long periods the stubborn resistance of large sections of the clergy, but in modern times it has been more successfully enforced.

The theory attributing a divine origin to this law has been now discarded. There is no trace of it in the New Testament. The theory that it was instituted by the Apostles lacks historical evidence. Not all the Apostles of Jesus were celibates. Of Peter we know from the Gospel that he had a wife. It is known also that Philip had four daughters. Of the other Apostles nothing is said in the New Testament, whereupon Tertullian (end of the 2d century) remarked that

they "were either eunuchs or they lived in continence." Clement of Alexandria is witness to another tradition holding that not only Peter but also Paul and several Apostles were all married men. Paul, however, urging his followers to shun marriage gave himself as an example (I Corinthians 7:7-8). But this exhortation was addressed to all the believers in view of the imminent return of Christ to establish the kingdom. On the other hand, Paul in the same Epistle defending his claim to rank with the other Apostles stated: "Have not we the power to take with us a woman among our sisters as the other Apostles do, the brothers of the Lord and Kephas (Peter)?" Was Paul speaking of wives as it is suggested by the mention of Peter, or merely of women companions in missionary journeys? At any rate, that the Apostles made no law concerning clerical celibacy is confirmed by the Pastoral Epistles attributed to Paul in the Catholic Bible, in which it is said that a bishop "should be a man without blame and married to only one woman" (Timothy III, 2-4; Titus I, 6).

The theory now prevalent assigns to the law of sacerdotal celibacy a mere ecclesiastical origin. Very early in the church virginity and continence were exalted as having a higher spiritual value than marriage: hence it was natural that some among the more spiritually minded members of the clergy should be or live as celibates. But most of them were married men living a normal family life. Down to almost the end of the 4th century there was no *general law* imposing celibacy as a clerical obligation. Very early also, celibate members of the clergy introduced the custom of living together with a pious woman, a virgin or a widow, in a kind of spiritual marriage for purposes of mutual comfort and edification. Abuses and scandals caused by this practice led the Council of Nicaea (325) to forbid the cohabitation of clergymen with women not of their immediate family. But the same council refused to pass any law imposing celibacy on the clergy.

A canon of the so-called Apostolic Constitutions (a collection compiled about 400 A.D.) but representing an older tradition, forbade second marriages to all clerics as being bigamous unions. According to St. Jerome (c.340-420) the church in his time was filled with deacons, priests, and bishops who had married twice. The notion of bigamy was later on extended even to first marriages contracted after the ordination, since the reception of a major order was described as being a holy indissoluble marriage of the ordained man with the church. These restrictions paved the way to a more rigid ecclesiastical discipline. The main problem was that of priests and bishops who had come from the ranks of married men and after their ordination continued to live and to have marital relations with their wives. They formed the large majority of the clergy. Abstinence from such relations was already practiced in some eastern churches, especially in Egypt, where the monastic influence was very strong, but not in the western churches till the Roman synod of 386 under Pope Siricius (d. 399). In his Epistles to the Spanish and African bishops Siricius made the rule that "The priesthood of the New Testament which every day celebrates the sacred mysteries at the altar must abstain always from the works of the flesh. To all clerics in major orders all sexual relations with their wives are strictly forbidden. Those

who disobey this law shall be deposed from their office and cut off from our communion." This law did not impose the separation of married clergymen from their wives. Cohabitation was still permitted: thus, as Pope Leo I (440-461) said, "on the one hand the sacredness of marriage is respected, and on the other hand the works of the flesh cease altogether."

The Churches of the Patriarchate of Constantinople, which ignored altogether Siricius' and other western decrees, enacted their own laws at the Council in Trullo (691) imposing celibacy only upon bishops. This law still observed by the Orthodox churches greatly affected their organization because all bishoprics were now filled by celibate monks, barring the secular clergy, usually married, from any access to higher positions in the church. The Nestorian Church, on the contrary, made of marriage an obligation for all members of the clergy from the patriarch to the lesser clerics.

In the Western churches, which prospered after the conversion of the barbarians settled in the provinces of the former Roman Empire, the laws of celibacy and clerical continence were more often disregarded than observed, as we learn from the acts of many synods and papal decretals. The moral level of the clergy sank even lower with the rise of ecclesiastical feudal holdings and baronies. Bishops and priests were mostly either married or lived openly in concubinage. The Gregorian Reform of the 11th century reestablished a measure of discipline by strictly enforcing the law of celibacy, but the evil of concubinage could not be suppressed altogether. There was even a recrudescence of it during the period of the Renaissance when high prelates and even some popes gave the bad example of having irregular families. It must be said, however, that throughout those centuries there were always in the church shining examples of clerical virtue and of strict observance of the laws of celibacy and chastity. The ideal of sacerdotal purity and renunciation was always kept alive.

After the Protestant Reformation which cast away the whole Canon Law, the Catholic Church by the disciplinary reform of the Council of Trent (1545-1563) was able to enforce more strictly the law of clerical celibacy and continence. This law being merely an ecclesiastical ordinance could be modified or abolished altogether by the supreme legislative authority of the church, the pope. As a matter of fact, Pope Pius VII (1800-1823) yielding to the request by Napoleon granted a dispensation from the vow of celibacy and chastity to hundreds of French priests who during the revolution had contracted civil marriages. Those priests, however, were reduced to the state of laymen unable to perform any religious ceremony or to fill any ecclesiastical office.

Bibliography.—A minute bibliographical survey of all texts and writings on this subject from early Christianity to 1860 was published in 1861 by A. de Roskovany (a volume in 8vo of 708 pages). A second volume brought the survey down to 1888. In the 19th century hundreds of writers, mostly Germans, dealt with this subject. The most complete work in English, though marred by inaccuracies, is still C. Lea's *An Historical Sketch of Sacerdotal Celibacy in the Christian Church*, 2d ed. (1884). See also Vacandard, E., "Les origines du célibat ecclésiastique," in *Études de critique et d'histoire religieuse* (1905); Leclercq, Dom H., "La législation conciliaire relative au célibat ecclésiastique," in the French edition of Hefele's *Histoire des Conciles*, vol. 2, pp. 1321 ff.; Thourston, H., "Clerical Celibacy in the Anglo-Saxon Church," in *The Month* (1909). For the evidence supplied by epigraphic material see Dom H. Leclercq, article, "Célibat" in Dic-

tionnaire d'Archeologie Chrétienne et de Liturgie, vol. 2 pp. 2808 ff. (1925).

GEORGE LA PIANA.

CELINA, village, Ohio, Mercer County seat altitude 875 feet, on the Cleveland, Cincinnati Chicago and St. Louis, and the New York, Chicago and St. Louis railroads. It makes furniture and has creameries and canneries. There are two hospitals and a public library. Celina was settled in 1834. It has mayor, council, and city manager. The water, power and light system are municipally owned. Pop. (1950) 5,703.

CELL, *The*. A microscopical unit of structure of living organisms. Large organisms have many cells, smaller organisms have fewer, sometimes only one. All cells have certain structural features in common regardless of the organism or tissue in which they are located, and under appropriate conditions they carry on the vital functions of respiration, metabolism, growth irritability, movement, reproduction, and so forth. They may live and reproduce after isolation from the parent body (tissue culture) and can be regarded as individuals of a lower order. All cells arise from pre-existing cells by cell division (doctrine of cell continuity). Since all vital activities are carried on by individual cells working either singly or in coordinated groups it is evident that all of the problems of normal or disordered function have their basis in cell physiology.

Methods.—The parts of a living cell are often nearly or quite invisible under the ordinary microscope, either because their refractive powers are so similar, or because their size lies below the limit of resolution of the lenses used. Techniques of killing, sectioning, and staining cells (classical methods) have long been used to make cell parts visible. These techniques have been particularly successful in studies of the chromosomes but less so when applied to smaller, highly hydrated structures.

New methods were developed to supplement the classical ones, some of which are listed here: (1) polarization microscopy—adapted to detect areas of molecular orientation; (2) ultraviolet microscopy—which improves resolution and gives differential absorption; (3) electron microscopy—which gives much higher resolution but is limited to thin, dead objects; (4) phase microscopy—which reinforces slight differences of refractive power; (5) microdissection—which utilizes apparatus for the dissection and injection of single cells; (6) centrifugation—which results in the stratification of the cell constituents and makes it possible to determine their relative densities; (7) microrespirometry—which permits the measurement of cellular respiration; (8) tissue culture—facilitating experimental treatment of living cells isolated from multicellular organisms; (9) biochemical and biophysical methods which have made possible the isolation and analysis of nuclei, of chromosomes, of chondriosomes and of several specifically different granules. These researches form the basis as triumphs of modern biological research.

Cell Structure.—A cell consists of a plasma membrane enclosing a mass of cytoplasm and a nucleus, (Fig. 1A, B, and C). Structures external to the plasma membrane such as hyaline membranes, the cellulose wall of plants, and the hard matrix of bone are cell products. The

plasma membrane plays a dominant role in determining what enters and leaves the cell, and the electrical charge upon it is related to the degree of excitation of the cell. It is believed that the plasma membrane may be only a few molecules thick and that it consists of highly oriented layers of protein and lipid.

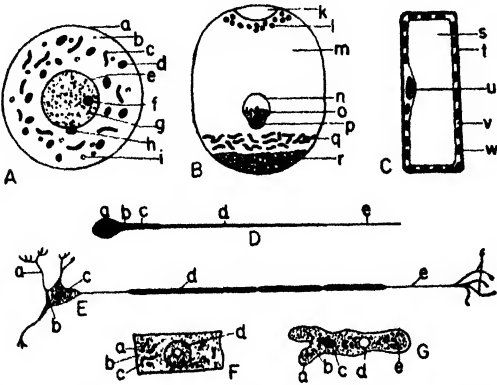


FIG. 1.—Diagrams of various types of cells. *A*, non-dividing cell showing structure: *a*, plasma membrane; *b*, cytoplasm; *c*, chondriosomes; *d*, stored material; *e*, nuclear membrane; *f*, nucleolus; *g*, chromatin; *h*, central body with paired centrioles; *i*, golgi material. *B*, centrifuged cell showing stratification of its contents in accordance with their specific gravities: *k*, oil at the centripetal pole; *l*, golgi material; *m*, clear cytoplasm; *n*, nucleus; *o*, chromatin; *p*, nucleolus; *q*, mitochondria; *r*, yolk. *C*, plant cell with *s*, large vacuole; *t*, cellulose wall; *u*, nucleus; *v*, cytoplasm; *w*, chloroplast. *D*, human sperm cell (spermatozoon) total length 0.60 mm. The nucleus is confined to the head: *a*, head; *b*, neck, containing centriole; *c*, middle piece, containing mitochondria; *d*, main piece, *e*, tail piece. *E*, motor nerve cell showing: *a*, dendrites; *b*, cell body, containing niessl granules; *c*, nucleus. The nucleus contains a nucleolus; *d*, myelin sheath; *e*, axone filament. *F*, cell from the embryonic region of a growing pea root tip: *a*, cell wall; *b*, cytoplasm, containing fine granular mitochondria and larger (*c*) amyloplasts. Amyloplasts may bear a round starch granule at one end; *d*, nucleus with chromatin and a nucleolus. *G*, unicellular animal, amoeba, showing: *a*, plasma membrane; *b*, food vacuole; *c*, nucleus; *d*, contractile vacuole; *e*, inner granular cytoplasm (endoplasm).

Cytoplasm.—The cytoplasm comprises all of the cell substance inside of the plasma membrane and outside of the nucleus. It consists of the structures diagrammed in (Fig. 1*A, B, C*) and listed below: (1) an apparently homogeneous ground substance, (2) visible and submicroscopic granules, (3) plastids, (4) golgi apparatus, (5) chondriosomes, (6) fibrils, (7) vacuoles, (8) stored products and crystals, (9) centrosomes, and, at the time of division, (10) the achromatic figure. The ground substance is an aqueous solution of soluble proteins, metabolites and salts, having the properties of a thixotropic gel. Some of the larger granules represent presecretion products (digestive enzymes, etc.). Some of the submicroscopic granules have been isolated in a relatively pure state and contain protein, nucleoprotein and intracellular enzymes. Stored products include starch in plants, glycogen, and fats and oils in animals. Sometimes crystals are stored in large numbers.

Plastids occur exclusively in plant cells. They include: (1) leucoplasts which are small and numerous in young cells; (2) chromoplasts which contain colored pigments. The most common being the chloroplast which contain

chlorophyll and is concerned with the formation of starch by photosynthesis and (3) amyloplasts which occur in roots and stems and are also concerned with starch formation. Plastids reproduce by division though not necessarily at the time of cell division. Their possible origin *de novo* is debated. It is believed that chromoplasts and amyloplasts are formed from leucoplasts. Plastids are generally inherited from the maternal parent.

In 1909, Camillo Golgi described the Golgi apparatus as a constant feature of certain nerve cells. A basic criterion for its presence was stainability with osmium tetroxide or silver nitrate associated with a high lipid content but many structures in different cells will stain with these reagents. Some workers question the validity of osmic or silver staining and prefer vital stains which demonstrate an "apparatus" of vacuoles. After many years of controversy authorities are still in wide disagreement regarding what is admissible as golgi. A group of osmium staining bodies, found in animal spermatocytes, fuse and produce the acrosome (penetrating tip) of the sperm. Osmium staining bodies are frequently associated with secretion granules or stored products suggesting synthetic activity. The "golgi apparatus" can be displaced as a unit in some centrifuged cells (Fig. 1*B*) so that it is impossible to doubt its reality in individual cases. The homologies and analogies of "golgi material" in different cells remain very uncertain.

The chondriosomes are of widespread occurrence in plant and animal cells. They may be filaments or granules (mitochondria) which move about rapidly in the cell (tissue culture), divide by fission and stain with Janus green or red. They have a relatively high specific gravity among cytoplasmic components for they are thrown centrifugally when centrifuged. Isolated chondriosomes from mammalian liver cells contain protein, nucleoprotein, lipid and enzymes among other substances. Critical evidence of their function is lacking although they are often associated with secretion products.

In many animal cells there is a central body which is passive except at the time of division. Sometimes a dotlike centriole (or a pair of them) lies in the center of the central body. During cell division the central bodies are at the poles of the gelated spindle which occupies the center of the cell and to which the chromosomes are attached. The central bodies represent the focal points of the astral rays. They perpetuate themselves by division but are also formed *de novo* under certain circumstances. They are included in the sperm and in many cases are introduced into the eggs at fertilization.

Nucleus.—The nucleus is surrounded by a membrane which encloses nucleoplasm, one or more nucleoli and chromosomes. It is often spherical but may be oval, irregular, and even fragmented. Its presence is essential to the continued life of the cell. An amoeba, for example, deprived of its nucleus may live for some days but will ultimately perish.

The chromosomes are the carriers of the genes. Their appearance differs markedly in different stages of nuclear development but they are most easily seen at the time of cell division. Structurally, they are threads which are contracted and coiled during division stages but are

much extended in nondividing cells. They (1) consist largely of nucleoprotein (2) exist as pairs, one member of maternal and one of paternal origin, which are, however, only closely associated during the first division of meiosis; (3) are generally of a constant number in all body nuclei; the number is a constant one for each species; (4) their pairing behavior and distribution during gamete formation in animals and spore formation in plants are consistent with Mendel's laws of segregation and independent assortment and with Morgan's laws of linkage and crossing over; (5) the chromosome number is perpetuated by a precise longitudinal division of each chromosome during mitosis. The science of cytogenetics has shown that each chromosome is differentiated along its length into regions (genes) responsible for the hereditary traits and by special techniques it has shown the position of particular genes on the chromosome. One or more chromosomes is often recognizable as a sex chromosome. Commonly a like pair occurs in one sex and an unlike pair in the other. In many animals and in some plants the sex is primarily determined by the distribution of the sex chromosomes, although the other chromosomes and sex hormones also exert their effects.

Size and Shape.—The size and shape of a cell are closely related to the functions it must perform (Fig. 1*D, E, F*). Red blood cells are small and smooth, favoring their passage through small capillaries. Many nerve cells bear a long cellular process over which the impulse is transmitted. Egg cells are relatively large containing much reserve nutrient for the prospective embryo. The human egg (diameter 0.135 millimeters) has about 7,000 times the volume of the human red blood cell. There is evidence that the size of a cell and the size of its nucleus are dependent characteristics (nucleo-plasmic ratio).

Exceptions.—There are certain exceptions to the generalized cell pattern; for example, voluntary muscle fibers of vertebrates and the hyphal threads of molds have many nuclei in a common mass of cytoplasm. Such exceptions are, however, fully consistent with the cell doctrine since their many nuclei arise from a uninucleate cell. Whether or not bacteria are cellular is undecided. A favored interpretation considers them to be plurinuclear cells. Colon bacilli, for example, have several condensed bodies which stain as desoxyribose nucleic acid as does chromatin, and can be considered as nuclei. How closely the stainable material of the chromosomes, the viruses and phages resemble cells remains for future work to determine.

Cell Division.—In mature organisms, cell division, is limited to cell replacement which proceeds constantly, for example, in the lower layers of the skin or in the blood forming cells of the bone marrow.

When a cell divides, its nucleus divides first, then its cytoplasm. Nuclear division is essentially similar in all forms with true nuclei, differing only in details. The process, diagramed in Fig. 2, called mitosis, can be summarized in the following steps: (1) The chromosomes of the nondividing cell are long, nonstainable and hydrated. Only scattered granules of chromatin are visible (Fig. 1*A*). (2) As the first phase of mitosis approaches (prophase) the chromosomes become shortened, stainable and dehydrated (Fig. 2*A, 2B*). (3) The nuclear membrane disappears

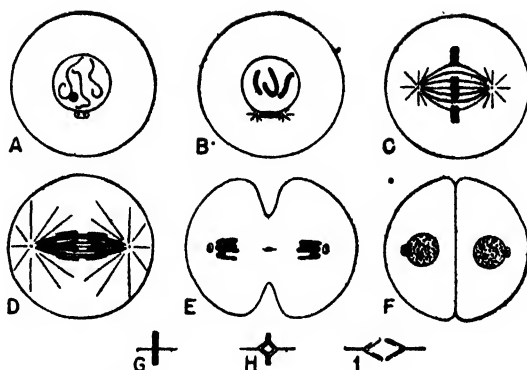


Fig. 2.—Diagrams of phases of mitotic cell division. *A*, early prophase—chromosomes condensing. *B*, late prophase—chromosomes further condensed, spindle and asters appearing. *C*, metaphase—spindle and asters well developed, chromosomes split ready for the separation of halves, chromosomes oriented at the spindle equator. *D*, Anaphase—chromosomes halves separating, spindle elongating. *E, F*, Telophase—chromosomes swelling and vacuolating, centrioles each divided, cell dividing. *G*, one chromosome with attached spindle fibers, showing the longitudinal split of the chromosome (metaphase). *H*, early stage of the separation of the chromosome halves (early anaphase). *I*, daughter chromosomes separated (anaphase).

and a gelated spindle appears, (late prophase). (4) The chromosomes become attached to the spindle by their kinetochores (spindle attachment bodies) and become arranged at its mid-plane (metaphase, Fig. 2*C*). (5) The half chromosomes separate, kinetochores first, and move towards opposite poles (anaphase, Fig. 2*D*). (6) The chromosomes swell, vacuolate (Fig. 2*D*) to form two new nuclei (telophase, Fig. 2*E* and *F*). Cytoplasmic division follows either by a constriction of the cell (animal cells) or by the formation of a cell plate across the equator of the spindle which is subsequently transformed into cellulose (plants). The essential feature of mitosis is the precise splitting of each chromosome in half, thus insuring each daughter cell an identical chromosome (and genic) complement.

Cell Differentiation.—During the development of an organism its constituent cells become specialized both in structure and in function. The cause of cell specialization is one of the outstanding biological problems. Progress has been made (a) by modifying the environment of a group of undifferentiated cells and thus altering their eventual fate, (b) in tissue culture by modifying the culture fluid, and (c) in embryos by transplanting and relocating patches of embryonic cells.

History.—Robert Hooke (1665) first used the term cell (cellula) in describing dead cell areas of cork. Robert Brown (1831) described the nucleus as a constant feature in plant cells. Matthias J. Schleiden (1838) and especially Theodor Schwann (1839) established the cell theory, recognizing the cell as a unit of structure in both plants and animals. They realized the common structure of cells in different tissues although they held erroneous views concerning cell origin. The doctrine of cell continuity was first clearly stated by Rudolf Virchow (1858) and the first careful studies of mitosis were made by Edward Strasburger and by Walter Flemming in 1875. The chromosome theory of inheritance was developed by Walter Sutton in 1904. Ross G. Harrison originated the tissue

culture technique in 1907.

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ALLAN C. SCOTT,
Union College, Schenectady, New York.

CELL, a small chamber; the dwelling of a hermit; a lesser or subordinate religious house dependent upon a greater, by which it was erected and under whose government it remained; the apartments or private dormitories of monks and nuns. In early Christian usage the word was also applied to a chapel erected over a tomb.

CELLE, tsël'ë, city, Germany, in the state of Lower Saxony, on the Aller River, 22 miles northeast of Hannover. It is a rail junction and the site of important oil, steel, and chemical industries. The city was chartered about 1292. Pop. (1950) 60,100.

CELLINI, chë-lë'në, **Benvenuto**, Italian goldsmith and sculptor: b. Florence, Italy, Nov. 3, 1500; d. there Feb. 13, 1571. Though he is now best known for his autobiography, which was not published until long after his death, Cellini achieved considerable fame during his lifetime as goldsmith and sculptor. His father wished him to become a musician, but he apprenticed himself to a goldsmith at the age of 15 and remained in this profession until the end of his life, devoting an increasing amount of time in his later years to sculpture. At 19, without even telling his father, he departed for Rome; as he says in the autobiography, "I had just 19 years then, and so had the century." From 1519 to 1540 he remained chiefly in Rome, returning to Florence several times (1521, 1527, 1528, 1535). On the last of these trips he remained for a while in the service of Duke Alessandro de' Medici. In 1537 he made a short trip to France. His headstrong, violent temperament, which led him constantly into trouble and more than once to murder, was responsible for several of these abrupt moves.

His early works in Rome show the influence of Raphael and his pupils and of the Milanese goldsmith and medalist Cristoforo Foppa Caradosso, as may be seen in a medal made about 1521 or 1522 for Scaramuccia Trivulzio, a seal made for Ercole Gonzaga in 1528, and the famous gold morse made for Pope Clement VII in 1530 and 1531. The morse, like most of Cellini's works in precious metal, is no longer extant, but its design has been preserved in careful water-color drawings made in the 18th century by Francesco Bartoli. Later, particularly after the trip to Florence in 1535, Michelangelo's influence is stronger. This may be seen in the medals made for Pope Clement VII in 1534, in that of King Francis I of France about 1537, and in the seal made for Ippolito d'Este in 1539.

His admiration for Michelangelo, which he expresses so often in the autobiography, shows most strongly in the famous gold saltcellar of Francis I, now in the Kunsthistorisches Museum in Vienna. Designed in Rome early in 1540, it was finished in France, where Cellini went later that year, remaining in the service of King Francis until 1545. Several of the figures decorating the saltcellar are copied directly from the statues symbolizing the times of day which Michelangelo made for the Medici tombs in

Florence between 1520 and 1534. Indeed the whole style of the sculptured figures on the saltcellar is an ornamental adaptation of Michelangelo's style. Impressive in scale (over 10 inches high and 13 inches wide), the elaborate table ornament features large nude figures of the sea god Neptune and a female figure symbolizing the earth. Handsomely shaped, these figures are in precariously balanced poses, achieving that combination of elegance and tension so popular in the mannerist style prevailing at this time. On the sea side are a richly shaped ship to hold the salt; sea horses and many kinds of fish, all worked in gold and enamel. On the land side the pepper container is in the form of an Ionic building ornamented with statuettes, and there are also many small land animals. On the pedestal are relief figures symbolizing the times of day and the winds. The constant change in scale in the human figures is a further element of tension, as are the closely intertwined forms and the actively fretted surfaces of the work.

All this is typical of mannerist art, of that anticlassical, anti-Renaissance style which gathered increasing momentum in the second and third quarters of the 16th century after the great climax of the Renaissance in the first decade of that century. Arising in and expressive of a time of crisis both in religion and in state affairs, mannerism matured in an atmosphere of increasing autocracy. In Cellini's work we see relatively little of the religious intensity found in Jacopo da Pontormo or in the late works of Michelangelo that Cellini so admired. We see, however, both in works such as the saltcellar of King Francis and in the many stories in the autobiography something of how princely patronage affected the growth of mannerism into an increasingly sophisticated and cerebral style.

As one can sense in the saltcellar of Francis, Cellini long had wanted to devote more of his time to sculpture, and the wise and liberal patronage of King Francis made this possible for him for the first time. Francis was delighted with Cellini's work and rewarded him bountifully, even presenting him with a castle for use as a home and workshop. Of the large-scale works he made in France only the bronze *Nymph of Fontainebleau* has been preserved. Made in 1543 and 1544 as part of an ornamental framing of a portal for the Palace of Fontainebleau, it was never installed there and is now in Paris in the Louvre. The mannerist taste for tense expression shows in the abrupt contrast in style between the rugged realism of the dogs, boars, and deer at the sides of the composition and the elegant, elongated nude form of the nymph.

In one of those sudden changes of heart which punctuated his life, Cellini began to worry about his sister and nieces at home and abruptly left his hard-won position in France and returned to Florence in 1545. Here he entered the service of Duke Cosimo I de' Medici and remained in Florence for the rest of his life. One of his first commissions on his return was the restoration of an antique marble torso, to which he added a head, arms, feet, and an eagle, transforming it into a Ganymede (now in the Bargello in Florence). The elongated mannerist proportions of Cellini's additions clash with the more heavily proportioned classical torso, showing how deeply ingrained a taste can become.

Renewed contact with classical works and with those of the great Renaissance masters,

Donatello and Michelangelo, seems to have revitalized Cellini's sculptural sense; his works in Florence show a marked improvement in quality over the *Nymph of Fontainebleau*. The most important of these works is the famous bronze Perseus, which still stands in the spot in the Loggia dei Lanzi for which it was made on the order of Duke Cosimo. This work occupied Cellini from 1545 until 1554. The dramatic story of his difficulties in casting it forms one of the most fascinating sections of his autobiography. Though the figure of Perseus is more heavily and more classically proportioned than most of Cellini's works, the flavor of the whole work remains mannerist in many important ways: in the strained, awkward relation of the helmet to the head; in the studied contrast of the handsome nude youth with the horrifying severed head of Medusa gushing blood; in the obvious relish taken by the artist in the gory aspects of the story. Again he accents marked changes in scale from the main group to the four small bronzes of gods in the niches of the pedestal and still further in the delicate elongated form of Andromeda in the relief below representing Perseus rescuing Andromeda (the original of which is now in the Bargello). The small bronzes in the pedestal niches are particularly beautiful and more typically mannerist in proportion and pose than the main figure of Perseus.

Two marbles also of mythological subjects, Apollo and Hyacinth (1546) and Narcissus (1547-1548) were long thought to be lost, but have been identified in the Bargello collections. Of Cellini's large scale portrait busts there remain the bronze in heroic scale of Cosimo I (1545-1548) in the Bargello and that of Bindo Aldoviti (1550) now in the Gardner Museum in Boston, Mass. His last important work in sculpture was the life-size marble crucifix now in the Escorial, Spain, which he made for his own tomb between 1556 and 1562. Poised and cool on first impression, this figure conveys intensity of feeling through subtleties of tense modeling and facial characterization.

In one of his many spurts of religious zeal, Cellini took preliminary vows in 1558, but sought and obtained release from them in 1560. About 1564 he married Piera di Salvatore Parigi. It was during these years (between 1558 and 1562) that he wrote his autobiography. Although the autobiography was not published until long after his death, the treatises which he wrote on goldsmithery and on sculpture between 1565 and 1567 were published in 1568 with a dedication to Bernardo Cardinal de' Medici.

Consult *The Life of Benvenuto Cellini, Written by Himself*, ed. by John Pope-Hennessy (London 1949). This edition contains the John Addington Symonds' translation, further notes, a critical introduction, notes on most of Cellini's extant works, and bibliographical references.

CELLINI'S AUTOBIOGRAPHY. Written between 1558 and 1562, the autobiography was not published until 1728, when the first Italian edition appeared. It was translated into English (1771), German (1796), and French (1822), becoming more and more popular in northern Europe with the growth of the Romantic movement, even becoming the inspiration for an opera, *Benvenuto Cellini*, by Hector Berlioz. Johann Wolfgang von Goethe was moved to translate it, and lavish praise has been heaped on it ever since the late 18th century. Horace Walpole declared it

"more amusing than any novel"; Stendhal, who knew and loved Italy well, found it the key to an understanding of "Italian character." Cellini's tale of intrigue, brawls, duels, and escapes is so violent and extravagant that often one hesitates to believe him, but he usually is corroborated by the accounts of other witnesses. And this facet of his story alternates constantly with other moods, giving us glimpses of his devotion to his art, his tireless energy, his moments of intense piety, his casual pleasures, his humor, his essential warmth of heart. In an age of proud individualists Cellini's vanity was not only normal, but almost a necessary weapon in the struggle for position and advancement. He begins by even attributing the naming of the city of Florence to a legendary ancestor, Fiorino of Cellino. Later he tells us almost casually of "the special gift which the God of nature bestowed on me, that is to say, a temperament so happy and of such excellent parts that I was freely able to accomplish whatever it pleased me to take in hand." However, he later criticizes the sculptor Jacopo Sansovino for boasting. And he is equally frank about his weaknesses. Some of the freshness and liveliness of the autobiography come from the fact that most of it was dictated; the original Italian is colloquial and racy. John Addington Symonds' translation (1887), though the best in English, errs in seeking to achieve a literary elegance not in keeping with the original text. Through Cellini's words we are given not only an unusually candid picture of himself but also of his time. As Goethe said: "I see the whole century in more real terms in the confused apprehension of an individual than in the clearest historical account."

CELLITES, sɛl'its, or **ALEXIAN BROTHERS**, a religious order, so called from their patron St. Alexius and from *cella*, tomb, from the fact that they originally cared for and buried plague victims. The brotherhood arose in Mechlin, Brabant, about 1300 to check the ravages of the black death and soon spread through Brabant, Flanders, and Germany. At first the Cellites were merely a pious society, intended to harbor the poor and indigent free of charge, to serve the sick, and to bury the dead. In 1469 they were organized as a religious order.

CELLOPHANE, sɛl'ō-fān, viscose solidified in thin, transparent, waterproof sheets, invented by Jacques Edwin Brandenberger, a French chemist of Thaan. Pursuing further studies of viscose, which had been manufactured in England since 1894, he discovered in 1908 a process for making brittle, sparkling, transparent sheets of regenerated cellulose, which he believed could be utilized commercially as wrappings for gift packages. Obtaining patents in Europe and the United States, he designed machines for its manufacture, perfected in 1912. As a trade mark he coined the word "cellophane," derived from the first syllable of "cellulose" and the last syllable of the Greek word *diaphane*, meaning transparent. During World War I the French government purchased his entire output to use as eyepieces for gas masks. When the war ended, Brandenberger had developed cellophane cellulose film into a stable product. A French company, the Comptoir de Textiles Artificiels, placed capital at his disposal, and a company called La Cellophane was organized in 1920. In 1923 a subsidiary of E. I.

Pont de Nemours and Company obtained from Comptoir the North American manufacturing rights, and the following year the first sheet of cellophane was produced commercially in the United States.

CELLULOSE, sĕl'ŭ-lās, an enzyme which acts in the digestion of cellulose, a carbohydrate which, in various forms, is universally found in plants. The result of this digestion is cellobiose, which, acted on by at least one other enzyme, is transformed into glucose. Thus there are two enzymes and probably more which effect the digestion of cellulose to glucose. These enzymes are present in certain microorganisms, notably fungi, which attack such substances as cotton fibers, flax, hemp during retting, cordage, paper.

CELLULOID, sĕl'ŭ-loid, an artificial substance invented in its modern form by the brothers Hyatt (Isaiah and John Wesley), of New Britain, N. J., in 1869 (patent issued 1870). It is commonly used as a substitute for ivory, bone, shell, rubber, and coral, and has a close resemblance to these substances in hardness, elasticity, and finish. It is composed of the lower nitrates of cellulose gelatinized in a solution of camphor in methyl or ethyl alcohol. The nitrates of cellulose are usually prepared by subjecting tissue paper to the action of a bath of mixed nitric and sulfuric acids for 20 minutes at a temperature of at least 30°C. The resulting substance is dried by blotting or by the use of alcohol, and incorporated by heat or mixture with alcohol, camphor, and any pigments or fillers that may be desired. The doughlike mass then resulting is pressed into forms by various means, and these forms are then being kept from one to six weeks at 60°C. to evaporate the alcohol. Celluloid is stable at 75°C. It is very inflammable and its low tensile strength makes it one of the strongest of artificial materials. It is used for films in cameras and moving pictures, but on account of its excessive inflammability is being replaced by preparations of cellulose treated with acetyl chloride. Celluloid varnishes for lacquering on metal are prepared from various pyroxylin preparations and pigments.

CELLULOSE, sĕl'ŭ-lōs. The cell walls of higher plants are made chiefly of cellulose, which is a carbohydrate having a composition corresponding to the formula $(C_6H_{10}O_5)_n$. It is very widely distributed in the vegetable kingdom and occurs in one form or another in practically every country in the world. The cellulose content of different plants varies considerably: cotton fibers contain in excess of 90 per cent cellulose, whereas saw wood contains but 30 per cent cellulose. Cellulose is found in wood; in cotton, kapok, and other seed fibers; in flax, jute, ramie, hemp, and other bast fibers; in straw, bagasse, rice hulls, and in a large number of other plants.

Cellulose cannot be used as a food by man or other carnivorous animals, since they lack the enzymes needed for hydrolysis. However, a small amount of cellulose is properly included in foods, as it gives bulk to the intestinal contents and aids in the movement of food through the intestinal tract.

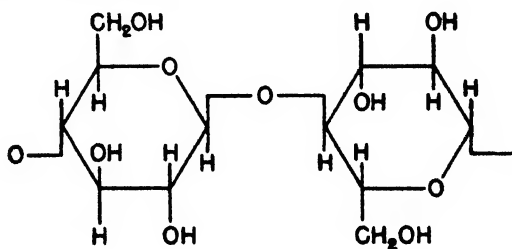
Historical.—The use of cellulose for making paper apparently had its origin at the beginning of the 2d century A.D. in China, spreading from

there to Arabia and then to several European countries. In the 15th century, paper made from vegetable fibers became an important product. Friedrich Gottlob Keller invented a mechanical process of making wood pulp in 1841 and the soda process was developed between 1851 and 1854 by the Englishmen Charles Watt and Hugh Burgess. The first sulphite process patents appeared in 1866; the sulphate or kraft process was developed in 1879 and was introduced in the United States in 1908.

The first known cellulose derivative, gun-cotton, or fully nitrated cellulose, was patented in 1846 by Christian Friedrich Schönbein. This was followed by a patent in 1855 for the manufacture of artificial threads from nitrated cellulose. Cellulose nitrate was the first synthetic plastic of industrial significance, being used as an ivory substitute in 1868 by John Wesley Hyatt. In 1890 the cuprammonium process for the manufacture of rayon appeared and in 1892 the viscose rayon process was introduced. In 1894 the first patent appeared for the production of cellulose acetate filament and in 1906 was made an acetone-soluble acetate which later was used as a non-inflammable lacquer for airplane wing coatings. Cellulose acetate plastics have won industrial importance since the early 1930's. Cellulose ethers were introduced in Europe in 1912 and the Dow Chemical Company developed methyl cellulose in 1939.

The conversion of cellulose in wood to fermentable sugars has received much attention, being first attempted on an industrial scale in 1910 and leading to the development of two industrial processes: the Bergins process which is based on using a 40 per cent hydrochloric acid; and the Scholler process which employs a dilute sulphuric acid solution.

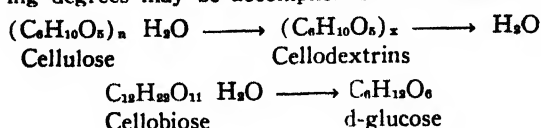
Chemical Nature.—The molecular weight of the building unit of cellulose is 162 and it can be considered a trihydric alcohol containing some 2,000 to 3,000 beta glucoside units. Structurally, a portion of the cellulose molecule may be represented as follows:



The above formula for cellulose derived from chemical evidence has been confirmed by X-ray examination. Furthermore, it has been shown that many of the molecules in the fibers are arranged with crystalline regularity and that the crystalline portions are separated by amorphous regions having an irregular molecular structure. The proportion of amorphous to crystalline structure affects the physical properties of the fibers, such as strength and flexibility.

Cellulose is insoluble in water, alcohol, ether, chloroform, and other organic solvents. It is soluble in Schweitzer's reagent which is prepared by agitating copper powder or copper hydroxide with concentrated ammonium hydroxide. Cellulose is also soluble in a mixture of one part of zinc chloride and two parts of hydrochloric acid.

Hydrolytic degradation of cellulose to varying degrees may be accomplished as follows:



It is possible to obtain a 95 per cent yield of glucose on complete hydrolysis of the purified cellulose.

Various means are available to effect the degradation of cellulose, resulting in a reduced molecular weight. In some phases of commercial practice this is performed to reduce viscosity, thus improving the ease of handling. Degradation can be performed with acid, alkali, and oxidizing agents resulting in end products such as hydrocellulose and oxycellulose.

Heat results in the destructive distillation of cellulose to end products such as ethylene, carbon monoxide, methyl alcohol, water, acetone, acetic acid, carbon dioxide and methane. Less drastic treatment results in a decrease of tear and bursting strength and viscosity while the copper number and acidity are increased. At 200°C. the fiber structure is lost and at 250°C. the material becomes practically amorphous.

Chemically, cellulose has been separated into several classifications and various analytical methods have been developed for their determination. The classifications include: alpha, beta, and gamma cellulose, alkali-soluble cellulose, chlorine demand, ether extract, ash, iron, manganese, calcium, and silica. Alpha cellulose is insoluble in cold 17.5 per cent sodium hydroxide; beta cellulose is soluble in 17.5 per cent sodium hydroxide and is precipitated on acidification with acetic acid; gamma cellulose is that portion that remains in solution after precipitation of the beta cellulose. The above specifications, including viscosity, are generally the basis upon which chemical cellulose is purchased.

SOURCES

Seed Hairs.—The matured cotton fiber is a flattened and twisted single hairlike cell. The cotton seeds are surrounded by the soft white fibers which have been used by man for years and of which there are two kinds. The long fibers are called lint and the short ones, fuzz. The lint length varies with different species averaging about one inch for the cotton produced in the southern United States.

The hairs are removed from the seed by a process known as ginning. The lint and fuzz still remain, however, and these are removed from the seed by a "linters" machine.

The cotton linters are sorted into various grades having different fiber lengths and known as first cut, second cut, mill run and hull fiber. First cut are used for surgical dressings, low-grade yarns and padding materials. Second cut and hull fiber are employed in the manufacture of chemical cotton.

A typical analysis of American raw cotton is given below:

Cellulose	91	per cent
Wax, etc.	0.35	per cent
Pectic Matter	0.53	per cent
Mineral Matter	0.12	per cent
Water	8	per cent

Cotton is the preferred material for the manu-

facture of cloth. It is readily purified and large quantities are used in the chemical field for products such as plastics, explosives, lacquers, and synthetic fibers.

Bast Fibers.—These fibers are present in the form of long bundles in the inner bark of various plants. Considerable use is found for these in the textile field. The bast fibers of the flax plant yield linen. The plant consists of 8 per cent of fiber.

The flax is prepared by a process known as retting which consists of a breakdown and partial cell separation by the action of bacterial enzymes. Its principal use is in the manufacture of thread and fine cloth.

The preparation of hemp fiber is similar to that of linen. The hemp fibers are less pliable than flax, however, and are coarse and dark colored. They are used in the manufacture of sail cloth, carpet warp, and other products where strength and durability are of primary importance. Manila hemp is prepared from the outer sheath of the stems of the abaca. Manila fiber waste is used in papermaking, especially where strength and toughness are required.

Jute fibers are obtained by retting or maceration. They are yellowish-white, soft, lustrous, and without great strength. They are used in the manufacture of burlap, twine, and as a backing for linoleum. Their principal disadvantages are lack of durability, lack of moisture resistance, and brittle nature.

Fibers Produced from Whole Stems.

Fibers of this type are derived from the entire stems and include materials such as straw, bamboo, esparto, rushes, bagasse, cornstalks, canes, papyrus, rice hulls, and many others. The uses they are put to are varied and include pulp and papermaking, wallboards, insulating materials.

Woods.—While almost any fibrous raw material can be reduced to a pulp, no source of cellulose has been found to equal wood when used for the manufacture of paper. Wood cellulose occurs in association with the hemicelluloses, which are structurally related, and with lignin. The wood is first subjected to slashing and debarking, whether it is to be processed as a chemical or mechanical pulp. Lignin separation is accomplished by treating with sodium bisulphite and sulphurous acid or with caustic soda. Industrially, the manufacture of pulp is distinct from the papermaking industry. The pulp plants will generally be situated near the source of raw material, in forests; whereas the manufacture of paper generally takes place near the market. Wood contains between 60 and 65 per cent cellulose, 20 to 25 per cent lignin, and smaller amounts of pentosis waxes, gums, and ash. Wood in various forms such as woodflour is used in impregnated and molded plastic compounds.

PRODUCTS

Chemical Cotton.—The raw cotton linters are cooked with steam in a rotary digester with a dilute caustic soda solution. The digester pulp which is gray in color is then washed and bleached with calcium hypochlorite solution, using sulphuric acid to accelerate the process and reduce the ash content. The white bleached pulp is washed, freed from foreign matter, and sent through rubber-covered rolls, where the excess moisture is squeezed out. The lumpy pulp is then pulled apart, dried in a tunnel drier, and the loose linters are baled for shipment. The chemi-

cal cotton consists of 98 per cent alpha cellulose. To manufacture sheet cellulose for use in viscose manufacture, the bleached cellulose is blended with several batches and sent to a "beater." The beating continues for several hours and works mechanically on the durable water-resistant wall of the cellulose fiber, breaking the wall down and allowing the inner fibrils to be exposed. The fibrils absorb water, swell, and expand. Where necessary, sizing and other material are added at this point.

The suspended cellulose is then charged to a conical or disc-type refiner, where the clusters and coarser particles are separated from the finer ones and reduced in size. The suspension is diluted with water, passed through a rotary shaking screen and, if a high-grade product is desired, through a centrifuge where impurities are removed. The suspension next passes to a Fourdrinier type of machine where it is formed into sheets.

Pulp and Paper.—Wood pulp is manufactured by the following processes: mechanical pulp, sulphate pulp, soda pulp, and sulphite pulp.

Mechanical pulp is obtained by grinding with water, screening, and concentrating in thickeners.

Sulphate or kraft pulp is made by digesting wood chips with sodium sulphide, caustic soda, and cooking with live steam. The resulting pulp is washed, screened, filtered, and concentrated. It is next bleached, washed, and rethickened and pressed into sheets which are folded into bundles and shipped to the paper mills. The soda pulp process is very similar to the sulphate process except that digestion is accomplished with a solution of sodium hydroxide in water.

In the sulphite process, sulphur dioxide dissolved in calcium or magnesium bisulphite is used.

Coniferous woods such as spruce, fir, and hemlock are used in the sulphite process; poplar, birch, chestnut, gum, and basswood are used in the soda process; coniferous woods are chiefly used in the sulphate process.

The conversion of pulp to paper is accomplished by first beating the pulp and adding alum sizing and bleaching materials. An aqueous suspension of the pulp is dehydrated on a screen and the resulting mat is squeezed between rollers to form a firm sheet. It may then be sent to a coating machine if a glossy surface is to be applied. Many variations from the above are practiced in the paper-manufacturing field.

Rayon by the Viscose Process.—Of the three processes for the manufacture of rayon, the viscose is the most important, as over 65 per cent of the cellulose base fiber is produced by this method. The finished rayon thread consists of smaller molecules than the original cellulose and possesses different physical properties.

The main reasons for its wide use are the inexpensive raw materials used, such as wood pulp, sodium hydroxide, carbon disulphide, sodium sulphate, and sulphuric acid.

Sheets of wood pulp are charged to a steeping press and soaked in an 18 per cent sodium hydroxide solution. The beta and gamma cellulose dissolve leaving the alpha cellulose which constitutes about 86 per cent of the original pulp.

After the excess liquor is drained off and further liquid removed by squeezing, the alkali cellulose is shredded and reduced to soft crumbs. These are aged and then charged into a horizontal iron drum mixer where a regulated amount

of carbon disulphide is added. The drum is rotated for several hours and the crumbs coagulate into small balls of cellulose xanthate. These are dissolved in concentrated sodium hydroxide and the product known as viscose solution results. This is blended with several other batches, aged for several days, filtered and de-aerated. The solution is forced under pressure through very small openings in spinnerets into the spinning bath. The diameter and number of holes are varied according to the type of yarn desired. The spinning solution which contains 9 to 11 per cent sulphuric acid, 15 to 20 per cent sodium sulphate, some glucose, and zinc sulphate regenerates the cellulose from the viscose solution in the form of filaments. The filament is washed, bleached, and dried. Cellophane manufactured by the viscose process is extruded through a thin slot into the coagulating bath and then washed, bleached, softened, and made moisture proof.

Rayon by the Cuprammonium Process.—The cellulose is dissolved in an ammoniacal copper hydroxide solution, diluted, and filtered. The solution is forced through a spinneret into a 5 per cent caustic soda solution which coagulates the filaments. These are stretched 40 to 60 per cent before entering a dilute sulphuric acid coagulating bath. The yarn is then washed, dried, and twisted.

Cellulose Acetate Rayon, Plastics and Film.—Cellulose acetate is not a regenerated cellulose and differs both chemically and physically from the other processed rayons.

The cotton linters are added to a mixture of acetic anhydride, acetic acid, and a catalyst such as sulphuric acid. Acetic acid is added, the solution aged, and then run into a large volume of water which serves to precipitate the cellulose acetate. The flakes are washed, centrifuged, dried, and dissolved in acetone, and the resulting solution filtered. It is forced through spinnerets into a rising current of warm air, and the cellulose acetate filaments are formed as the acetone evaporates. The economics of the process depend on the efficient recovery of chemicals used.

A transparent cellulose acetate film is manufactured by extruding the acetate solution through a narrow slit onto a drum.

Cellulose acetate can be injection molded, compression molded, or extruded to produce useful articles of many shapes and sizes. Plasticizers and dyes are usually mixed with the cellulose acetate flake prior to forming.

Cellulose Nitrate.—Treatment of cellulose with a mixed acid consisting of nitric and sulphuric acids results in a nitrated cellulose as represented by the following reaction:



The degree of nitration can be varied and this in turn determines the characteristics and application of the nitrated cellulose.

Nitrogen Per Cent	Soluble in	Industrial Application
10.7–11.2	Ethyl alcohol	Plastics
11.2–11.7	Methyl alcohol, ethyl alcohol, ethyl acetate, etc.	Artificial fibers, photo- graphic film
11.8–12.3	Amyl acetate, ace- tone, ester solvents	Lacquers, artificial leather, explosives
12.4–13.0	Acetone	Smokeless powders and explosives

Purified cotton linters and bleached sulphite pulp

are commonly used for nitration. Previously the chief raw material used was cotton linters; however, of late wood pulp has been used in increasing amounts.

Ethylcellulose.—Ethylcellulose is manufactured by treating cellulose as derived from wood pulp or cotton linters with a concentrated sodium hydroxide solution and then alkylating the alkali cellulose with ethyl chloride or sulphate. The ether formed is washed and further processed. Ethylcellulose is a plastic material finding application as a coating material particularly for wire insulation and it can be readily injection molded to produce a wide variety of useful products.

CELSIUS, sěl'si-ūs, the name of a Swedish family, several members of which attained celebrity in science and literature: 1. **MAGNUS CELSIUS**: b. in the old province of Helsingland 1621; d. 1679. He became professor of mathematics in the University of Uppsala and published two works on the antiquities of his native province; he was the discoverer of the Helsing runes. Besides mathematics and archaeology, he cultivated poetry with some success, and was so skilled in practical mechanics that he himself made all the scientific instruments he required in his astronomical observations. 2. His son, **NILS CELSIUS**: b. 1658; d. 1724; also filled the mathematical chair in Uppsala University. 3. **OLAF CELSIUS**, another son of Magnus: b. 1670; d. 1756. He early became famous as an earnest student of the Oriental languages and of botany. He was successively appointed to the chairs of Greek, Oriental languages, and theology, and filled the office of provost of the cathedral at Uppsala. Much of his attention was given to the study of runology. He was among the first to recognize the genius of Carolus Linnaeus, whom he liberally patronized. In 1745–1747 he published his voluminous work, *Hierobotanicon*, a description of all the plants mentioned in the Bible. 4. **ANDERS CELSIUS**, son of Nils Celsius, and the most distinguished of the family: b. Uppsala, Nov. 27, 1701; d. there, April 25, 1744. After his appointment as professor of astronomy at the University of Uppsala in 1730 he visited numerous observatories in Germany, Britain, France, and Italy. In 1733 he published at Nuremberg a collection of observations of the aurora borealis made during 1716–1732 by himself and others. During 1736 he took part in an expedition to Lapland organized under the auspices of the French Academy for the purpose of measuring a degree of the meridian. Louis XV of France granted him a pension for these services. In 1740 he supervised the building of an observatory at Uppsala, and he served as its director until his death. He read a paper before the Swedish Academy of Sciences in 1742 giving the first description of the centigrade or Celsius (q.v.) thermometer. Adoption of the Gregorian calendar was advocated by him. His works included *De observationibus pro figura telluris determinanda* (1738). 5. **OLAF CELSIUS** the younger was the son of Olaf Celsius (1670–1756) and cousin of Anders Celsius: b. 1716; d. 1794. In 1747 he became professor of history at the University of Uppsala, and from 1777 he was bishop of Lund. Among his historical works were biographies of Gustavus I and Eric XIV.

CELSIUS, in thermometry, is the scale, also known as **CENTIGRADE**, in which the inter-

val between the ice point and the steam point under standard atmospheric pressure is divided into 100 degrees. The term Celsius is analogous to the names Kelvin, Fahrenheit, Réaumur, and Rankine, used for other temperature scales, for it perpetuates the name of Anders Celsius (q.v.) who, in 1742, first proposed such a division. The Ninth General Conference on Weights and Measures, held in Paris during October 1948, adopted the designation degree Celsius in place of degree centigrade or centesimal, and on Jan. 1, 1949, the National Bureau of Standards, in common with other national laboratories in the United States, began to use it. While the bureau recommended that scientists and industrial workers elsewhere conform, it was not considered practicable to impose the term Celsius on those who preferred centigrade. See **THERMOMETER**.

CELSUS, Platonist philosopher, an antagonist of the Christian religion in the 2d century. He is believed to have been the same Celsus, friend of Lucian, to whom is inscribed Lucian's satirical sketch of the life of the noted imposter and pseudo-thaumaturgus Alexander of Abonotichus, entitled *Pseudomantis*. No work of Celsus has come down to us in its integrity or in its original form, but his *True Discourse* is in substance preserved for us in the eight books of Origen's computation of the arguments brought by Celsus against the truth of the religion of Christ. It was written at Rome in the latter part of the 2d century. Origen quotes textually long passages from the *True Discourse* in his work *Against Celsus*. From these passages it is seen that Celsus had accurate knowledge of the religious creed and practices, both of the Jews and Christians, and he skilfully puts in the mouth of a Jew his criticism of the life of Jesus as told in the Gospels. Celsus himself appears to have been an epicurean and a scoffer at the supernatural, while his Jew is a firm believer in miracle, but for all that he cannot accept the Gospel stories. He rejects the doctrine of the Incarnation of God, and reports a scandalous story of an amour which he offers as a substitute for the evangelists' narrative; and the fact Origen quotes the passage containing this shockingly blasphemous suggestion (as it must have been regarded by him) is evidence that the Christian polemist is dealing fairly with his antagonist. According to Celsus, Jesus once visited Egypt and there learned the art of the jugglers; in his own country he easily won reputation as a wonder-worker, even a god. By his jugglery he might have made the multitude present at his immersion by John in Jordan believe that they heard a voice from heaven. If he was God, he would have made a better choice of apostles: why did he choose Judas? The story of the resurrection is self-contradictory. His death by crucifixion is undisputed and was a fact of public notoriety; if he rose from the dead, why did he not make the fact equally notorious and public? With such objections Celsus attacks the Christian faith in the first half of his work; in the second half he speaks in the person of a Grecian philosopher. Whatever is true and good in the Christian system exists already in the schools of philosophy; therefore, let the Christians abandon their narrow sectarianism and separatism and combine with all good and wise men in upholding the principles of good

government. Celsus then advances philosophical arguments against the credibility of the Christian mysteries, in particular the incarnation. God cannot assume a mortal body either in reality or in appearance only: not in reality, for that would be contrary to His nature; not in appearance, for that would be a fraud. But the idea of an incarnation of God is absurd: what could be gained by an incarnation? Certainly no advantage for God; but neither for men: do men know God better for seeing Him in bodily form? Did God a little while ago waken from sleep and resolve to save a few men from sin, leaving the mass of mankind to go down to hell? In his closing appeal he makes overtures for peace with the Christians, urging them to be good citizens and to retain their own private beliefs if they like, but to conform outwardly to the state religion.

Consult Froude, J. A., *Short Studies*, No. 4 (1883).

CELSUS, Aulus Cornelius, Roman writer on medicine who lived, probably, under the reigns of Augustus and Tiberius. He has been called the Roman Hippocrates, because he imitated the Greek physician, and introduced the Hippocratic system into Rome. He also wrote on rhetoric, the art of war, and agriculture. He is, however, best known as a medical writer. His work on medicine is an inexhaustible source from which other authors have drawn materials. Many editions of his *De Medicina*, comprising 8 books, have appeared throughout the years in several languages. The first edition was published in Florence in 1478. An English translation by James Grieve came out in 1756 (3d ed. Edinburgh 1837), and more recently a translation in English has appeared by W. J. Spencer (3 vols., Cambridge, Mass., 1935-1938).

CELTIBERI, sêl-tî-bêr'î, a people of ancient Spain, supposed to have arisen from a union of the aborigines, the Iberians, and their Celtic invaders. Various limits have been assigned to their country, which included probably all the north of Spain as far south as the sources of the Guadalquivir. They were divided into four tribes and were of the bravest and best of all the peoples of the peninsula. They excelled equally in cavalry and infantry. Hannibal subdued the Celtiberi, and they afterward passed under the Roman yoke. They revolted in 181 B.C., and were subdued by Tiberius Gracchus 179 B.C. Two struggles for independence followed, called respectively the first Celtiberian Numantine, and the second Celtiberian or Sertorian wars, in the latter of which they were finally vanquished; after 72 B.C. they do not again appear in history.

Consult Schulten, A., *Numantia*, 4 vols. (Munich 1914-1931).

CELTIC CHURCH, sêl'tîk or kêl'tîk, the name applied to the Christian Church in Great Britain and Ireland before the mission of Augustine (597) and which for some time thereafter maintained its independence by the side of the new Anglo-Roman Church. In Britain, the origin of the Christian Church remains in obscurity. There are sufficient records, however, to prove that throughout the 4th century there was a well-organized church in Britain which stood in constant touch with the rest of the church, particularly in Gaul, and considered itself an active part

of that body. In the 4th century, there are records of bishops, but for a hundred years after the mission of Saint Germain (Germanus) (429) nothing is heard of the church in Britain. The Anglo-Saxon conquest drove the Britons to the mountains of the west, where, in the 6th century, Christianity again became prominent. There were several minor differences between the Roman forms. The day of Easter, according to the former, followed the Eastern calendar; and there were also divergences in the methods of administering baptism. The coming of Saint Augustine in 597 introduced the Roman form of Christianity which gradually gained precedence over and absorbed the Celtic. In 777 its ascendancy was complete in Britain and south Wales. Still the Celtic Church continued farther north until 1172 when Queen Margaret introduced complete reforms.

In Ireland, there is much legendary history concerning the foundation of the church, which indicates that Christianity was brought from Britain to Ireland as the natural result of the close intercourse between those countries. The establishment of the church itself seems to have been an outcome of the first mighty wave of monasticism which swept from Egypt over Gaul and Britain and carried a number of half-Romanized Christians to Ireland. The first important figure in the history of the church in Ireland is Saint Patrick (389?-461), who converted the island and was most active in preaching and founding churches. In the region now known as Scotland, Saint Ninian, Saint Columba, and their fellow apostles established institutions which were monastic and missionary in nature. From Iona as a center, the movement soon embraced all of Northumbria. The Celtic Church there was finally fused with the Roman in 664; the Scottish and Irish churches lost their individual character in the same year, from which time their histories are identical with the Roman Church. See CULDEES.

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CELTIC LANGUAGES. The Celtic languages form the most westerly group of the Indo-European family of languages, all of which seem to descend from a common origin, or are at least characterized by a closely related system of phonetics and morphology, as well as by a common vocabulary and the same syntactical structure. The Celtic languages, which have been spoken by different branches of the Celtic peoples (q.v.) from prehistoric times to the present day, belong to the so-called *centum* group of the Indo-European dialects. The *centum* group to which belong Italic, Germanic, Greek, Venetic, Illyrian, as well as Tocharian and Hittite, have preserved the Indo-European palatal consonants as occlusives, while in the so-called *satem* group (Albanian, Armenian, Balto-Slavic, Indo-Iranian) they became sibilants. So we have in

Welsh *cant* (hundred) as in Latin *centum*, as opposed to Avestic *satam*, going back to an Indo-European **kṛntóm*.

Phonetic Characteristics.—The most notable phonetic characteristics which set off the Celtic languages from the other members of the Indo-European family are: (1) The dropping of the initial and intervocalic *p*: compare Latin *pater* with Old Irish *athir* (father); Gaulish *are-* (beside) and Irish, Welsh *ar* with Greek *πᾶρ, παρά*; Gaulish *ver-* (over), Irish *for*, Old Welsh *guor* with Greek *ὑπέρ*.

(2) The Indo-European medial aspirates *bh*, *dh*, *gh*, and *ǵh* have completely fallen together with the simple voiced stops: compare Old Irish *-biur* (I carry) with English (I bear), Latin *ferō*, Greek *φέρω*; Old Irish *-tiag* (I go) with Greek *στείχω*.

(3) The Indo-European labialized velar *gʷ* has become *b*: compare Old Irish *bó* (cow), Welsh *buwch* with Greek *βοῦς*, Sanskrit *gauh*; the change of the Indo-European labialized voiceless guttural *kʷ* and of *k + ʰ* to *p* is only found in Gaulish and Brythonic (see later discussion).

(4) The Indo-European vocalic *r* and *l* appear before stops and *r*, *l*, *m*, *n*, as *ri* and *li*: compare Gaulish *ritu-* (ford), Welsh *rhyd* with Latin *portus* (harbor), German *Furt* (ford); Gaulish *litanos* (broad), Old Welsh *litan*, Old Irish *lethan* (broad) with Greek *πλάτανος* (plane-tree).

(5) The Indo-European *ṛ* is changed to *i*: compare Gaulish *rīx* (king) Old Irish *rí* (king), Welsh *rhi* (prince) with Latin *rēx* (king).

(6) Indo-European *ō* is changed to *ā*: in final syllables to *-ā*: compare Gaulish *gnātos* (familiar), Old Irish *gnáth* (known), Welsh *gnaeth* (customary) with Latin *(g)nōtus*, Greek *γνώτός*; compare Old Irish *cú* (dog), Welsh *ci* with Sanskrit *śvā*, from Indo-European *kūō(n)*.

(7) Indo-European *ei* has become *ē*: compare Gaulish *dēuos* (divine) Old Irish *día* (god), Old Welsh *duiu-tit* (god-head) with Latin *dīvus*, god(like), Sanskrit *dēva-h*.

Morphology.—The Old Celtic morphology must have been very archaic: the neuter gender as well as the dual of the noun were preserved, while the verb shows a similar rich inflection like Greek and Sanskrit. Celtic and Indo-Iranian are the only Indo-European languages which have preserved the distinction between masculine and feminine gender in the numerals *three* and *four*: Old Irish masculine *trí* (three), Welsh and Breton *tri*, feminine Old Irish *téoir* (Indo-European **tisores*). Middle Welsh and Breton *teir*, Sanskrit masculine *tráyah*, feminine *tisráh*; Old Irish masculine *cethair* (four), Welsh *pedwar*, Breton *pevar* (Indo-European **k^uetuores*), feminine Old Irish *cethéoir* (Indo-European **k^uetesores*), Middle Welsh *pedeir*, Breton *peder*, Sanskrit masculine *čatvараh*, feminine *čátasrah*.

The closest analogies, however, are found between Celtic and Italic. It is true, the passive and deponent formations in *-r* are found not only in Celtic and Italic, but also occur in Venetic, Indo-Iranian, Phrygian, Armenian, Hittite and Tocharic. The genitive singular in *i* of masculine and neuter *o*-stems is also found in Venetic and Messapic (Illyrian); but the assimilation of an initial Indo-European *p-* to a following *k^u* is

an innovation, only found in Italic and Celtic: Indo-European **penk^ue* (five) becomes Latin *quinque* and Old Celtic **quenque*, hence Old Welsh *pimp*, Breton *pcmp*, Old Irish *cóic*. The superlative in **-samo-* is only found in Celtic and Italic: Gaulish *Belisama* (the very shining one), Old Welsh *hinham* (oldest, from **senisamos*), Old Irish *nessam* (nearest), Oscan *nessimas* (nearest; nom. pl. fem.), Latin *maximus* (greatest). Both languages had subjunctives in *-ā* and *-s* under similar morphological and phonetic conditions; both have (independently) created a *b*-future: Latin *amābō*, Old Irish *léiciub* (I shall leave); and both formed verbal nouns in *-tiō(n)* and used the old verbal adjective in *-to-* to form a passive preterite.

All those morphological agreements point to very old relations between Celtic and Italic. A close neighborhood in prehistoric times would be sufficient to explain them. On the other hand, the vocabularies of both languages, though they show some interesting agreements [Old Irish *dí* (of, from) = Latin *dē*; Old Irish *den* (strong) = Latin *bonus* (good), archaic *duenos*], are not so similar as to justify the assumption of a former genealogical Celto-Italic unity.

The vocabulary of Celtic and Germanic shows far more identical words: Gothic *aiths* (oath) = Old Irish *oeth*; Gothic *rūna* (secret) = Old Irish *rūn*; Gothic *freis* (free) = Welsh *rhydd*; Gothic *haiþi* (field), English *heath* = Welsh *coed* (wood); Old English *wudu* (wood) = Gaulish *vidu-*, Old Irish *fid*. Many of these words may be Celtic loans in Germanic, as for certain Gothic *andbahts* (servant), hence German *Amt*, from Gaulish *ambactus*; or Gothic *reiki* (empire) from Gaulish **rigion*. But the morphology of both languages is very different. This points to rather late relations between Celts and Germans, after their morphology had already been fixed.

The numerous common religious terms between Celtic and Indo-Iranian are rather to be explained as survivals from the Indo-European past, while the many agreements between Celtic and Baltic and Slavonic vocabulary may be due to the wanderings of the Urnfield people (see CELTIC PEOPLES).

CELTIC LANGUAGE GROUPS

The Celtic languages fall into 2 main groups: Goidelic (called today Gaelic) and British (also called Brythonic). This cleavage already appears on the earliest Celtic monuments. *Ancient Goidelic* is characterized by (1) the preservation of Indo-European *k^u* and *k + ʰ* as *qu*: *equos* (horse); (2) the change of Indo-European sonant *m*, *n* before stops to *em*, *en*: **kenton* (hundred); (3) the preservation of initial *sr-*: *srutus* (stream).

Ancient Brythonic is characterized by: (1) the change of Indo-European *k^u* and *k + ʰ* to *p*: *epos* (horse); (2) the change of Indo-European sonant *m*, *n*, before stops to *am*, *an*: *kanton* (hundred); (3) the change of initial *sr-* to *fr-*: *frutus* (stream).

Continental Old Celtic (often called *Gaulish*), mostly belongs to the Brythonic group, but the language of the Celtiberians and of some other Spanish Celts can be shown to have belonged to the Goidelic group. All we have left of Gaulish, as spoken in Gaul, Spain, northern Italy, and the rest of Europe, are about 60 inscriptions: some in the North Etruscan alphabet of the 2d

The asterisk (*) indicates that this particular word form is conjectured and reconstructed.

century B.C.; some in the Greek alphabet or in the Latin alphabet of Roman imperial times, to which have been added over 60 graffitos from La Graufesenque (Aveyron) with lists and accounts of potters. The Goidelic inscriptions of the Celtiberians are mostly in Iberic alphabet.

Apart from Celtic words recorded by classical writers, there have been preserved a large number of personal and place names in literature, on coins, and on Greek and Latin inscriptions all over Europe. Celtic place names are found as far east as the Dniester (*Carro-dūnon*, Wagon-fortress), the Dobruja, Galatia in Asia Minor, and as far north as Westphalia. They are mostly compounds with *-dūnon* (fortified place), *-brigā* (height, fortress), *-magos* (field), *-ialon* (clearing), or derivatives from personal names with the suffix *-ācon* (Latin *-ācum*). Though there must have been dialectic differences in such a huge territory, almost no trace of such appears in the numerous place names and proper names on inscriptions; St. Jerome tells us that the speech of the Galatians in Asia Minor bore a strong resemblance to the language he had heard spoken in the neighborhood of Trier (386 A.D.).

No written trace of the rich oral Gaulish literature has survived. More than 200 Celtic words have been preserved in the Romance languages, mostly terms referring to agriculture, peasant life, and plant names. Celtic speech seems to have died out in Gaul in the course of the 5th century A.D., but probably survived much longer in the mountainous parts of Switzerland. Celtic idiom spoken in Brittany today is not a survival of Gaulish but the language spoken by those Brythons who fled from the southwest of England to Armorica in the 5th and 6th centuries of our era, being driven out by the Saxons.

Insular Celtic, like continental Celtic, is divided into two groups: Goidelic and Brythonic, but their divergences are much greater than on the Continent. The chief differences developed only from the 6th century A.D. onward, so that today an Irish speaker could not make himself understood to a Welsh speaker, while in St. Patrick's time mutual communication could not have been difficult.

Goidelic or Gaelic.—The name Goidelic comes from the ancient name of the people, the *Goidil*, known to the Romans by the name of *Scotti*. The territorial subdivisions of Gaelic are: (1) Irish or Irish Gaelic (native *Gaedhealg*) in Ireland; (2) Scottish Gaelic (native *Gáidhlig*), sometimes called Erse (= Irish) in the northern and western Highlands of Scotland and the adjacent western islands where it was introduced by the Irish settlers (called in Latin *Scotti*), from about the 6th century A.D.; (3) Manx (native *Gailck*), the language formerly spoken in the Isle of Man, now almost extinct. Linguistically these are really nothing more than dialects of one language, Old Irish; we possess no monuments of Scottish Gaelic and Manx in the oldest period: Until the end of the 18th century, though spoken Irish and Gaelic had diverged to a considerable extent, the same literary language as passed current in Ireland continued to be employed by Scottish writers.

Irish.—Of all the Celtic languages, Irish is by far the most important because of its wealth of archaic features and abundance of linguistic material. The language of some of the Ogam, q.v. (Ogham) inscriptions (5th to 7th century A.D.) is almost as archaic as that of Continental

Celtic. Altogether there are about 370—short inscriptions on gravestones and boundary stones, almost exclusively containing proper names—most of which have been found in the southern half of Ireland. Those found in Britain (48), chiefly in Wales, are due to colonists from southern Ireland. The 16 "Pictish" inscriptions in Scotland are written in an unknown language. The Ogam alphabet consists of 1-5 strokes or notches scored on either side of the edge of an upright stone, originally no doubt on wooden staves.

The literary tradition begins with Old Irish, written in Latin cursive script, from about 600 to 900 A.D. Much Old Irish linguistic material has been preserved, in slightly modernized form, in Middle Irish manuscripts. Middle Irish, distinguished from Old Irish chiefly by the weakening of vowels in unaccented syllables and the reduction of flexional forms, extends to about 1400. The language was not the popular language but rather that of literature; the literary classes had at their command a standard form of Irish which educated men understood everywhere. As the result of the English conquests there came about the dissolution of the standard literary language. From the 16th century a dialect with well defined characteristics was spoken throughout the southern half of Ireland. Northern Irish is subdivided into two lesser dialects, one of them in Connacht, the other (strongly influenced by Scottish Gaelic) in Ulster. Irish is still spoken in the southwest, west, and northwest of Ireland. In the mid-19th century 4 million out of 7 million persons spoke Irish as their mother tongue, of whom 1 million spoke only Irish. In 1952 the number of Irish speakers among a population of approximately 4,300,000 is only 740,000, most of whom are bilingual.

Scottish Gaelic.—Scottish Gaelic was differentiated from Irish chiefly on account of the strong Norse influence. The sound shifting of the voiced *b, d, g*, to the voiceless stops *p, t, c*, was accompanied by a change of the historic voiceless stops *p, t, c* which are, when initial, pronounced with a following strong aspiration, and when they follow the stressed vowel become the preaspirated occlusives *chp, cht, chk*, a curious parallel to the prehistoric Germanic sound shifting. In 1931, out of a total of 4,842,980, the number of Gaelic speakers was about 137,000, 7,000 of whom spoke only Gaelic, to which may be added 30,000 bilingual speakers in Canada.

Manx.—Manx stands in a much closer relation to Scottish Gaelic than to Irish. It is written in a kind of phonetic spelling, based on Anglo-Scottish orthography. Its most distinctive feature is a peculiar stress system. Many disyllabic words with final long syllable shifted their stress to the second syllable as a result of Anglo-Norman influence; the same happened in Southern Irish. Somewhat later long terminations of those words which had escaped the accent shift were shortened, probably under the influence of Scottish Gaelic. The Manx vocabulary contains a fairly great number of Norse and English loan words. In 1875 there were still 12,340 people out of a population of 41,048 (exclusive of the capital, Douglas) who used Manx as their everyday language, among them 190 who spoke nothing but Manx. In 1952 there were only about 20 people who still could speak Manx.

British or Brythonic.—The term British or Brythonic comes from *Brittones* (Welsh *Bry-*

thon), a byform of Latin *Britanni*, the inhabitants of the Roman province *Britannia*. It comprises: (1) Welsh (native *Cymraeg* from *Cymro* meaning "fellow countryman"), so called from the Celtic people, the *Volcae*, whose name was extended by the Germans to all their western neighbors, in this case to the inhabitants of Wales; (2) Cornish (native *Kernewek*), the language of the Cornwall Peninsula, extinct since the end of the 18th century; (3) Breton (native *Brezhonek*), the several dialects of the Breton Peninsula.

Welsh.—Welsh is the most important language of the Brythonic group. Old Welsh (from 800 to 1100 A.D.) is known to us almost entirely by means of glosses, isolated words and proper names, but some Old Welsh texts have been preserved in Middle Welsh dress. Middle Welsh (from 1100 to 1500) is much more simplified than Old or Middle Irish. There remain only faint traces of case forms (mostly in the formation of the plural), the dual and the neuter gender, and the inflexion of the verb does not show as many archaic traces as that of the Irish verb. Spoken Welsh may be divided into North and South Welsh, each of which is further divided into two groups. In 1931 out of a total population of 2,472,377, there were over 900,000 Welsh speakers of whom 98,000 spoke only Welsh.

Cornish.—Cornish which stood in a much closer relation to Breton than to Welsh, can be divided into Old Cornish, known only by glosses and proper names (from 900 to 1100), Middle Cornish (until 1600), and Late Cornish.

Breton.—Breton is divided into Old Breton (from the 9th to the 11th century), known likewise only by glosses and proper names, Middle Breton (until the 16th century), and Modern Breton, which is composed of four chief dialects of Léon, Cornouailles, Tréguier and Vannes. The last named differs greatly from the others, chiefly by preserving the old British stress on the former penult, which is now, after the loss of the final syllables, the final syllable.

Pictish.—Pictish, the language of the Picts (Latin *Picti*) in the north of Britain, has left scarcely any traces beyond 16 "Pictish" inscriptions in an unknown language, and a few proper names, some of which seem to be non-Celtic, and some Goidelic and British. It is not impossible that a Goidelic dialect was spoken in Pictland before the coming of the Scots.

INSULAR CELTIC VARIATIONS

Differences Between the Goidelic and Brythonic.—The chief differences between insular Goidelic and Brythonic are: (1) While Old Celtic (Gaulish) seems to have preserved the free Indo-European accent, as shown by the development of Gaulish place names in French (*Némausus*: French *Nîmes*; *Tricasses*: French *Troyes*; but *Bituriges*: French *Bourges*; *Eburóvices*: French *Eureux*), the accent rules in insular Celtic have become mechanical. In Irish the stress always fell on the first syllable, causing the loss of vowels in post-tonic syllables, but in Brythonic it fell on the penult before the loss of final syllables. Afterward it was again shifted to the new penult: compare Old Irish *Eriu* (Ireland) from Goidelic *Élcríú*, genitive *Ércnn* from **Éveríónos*. The same **Éveríónos* became in Welsh *Iwérdon*.

(2) Initial *s-* was preserved in Irish but became *h-* in Brythonic: compare Gaulish *senos* (old), Old Irish *sen*, with Welsh and Breton

hen. The treatment of the *s-* groups also varies a great deal in Irish and Brythonic.

(3) In Irish the old Old Celtic voiceless stops *t* and *k* became voiceless spirants *th* and *ch* in intervocalic position, while in Brythonic the old Celtic intervocalic stops *p*, *t*, *k*, became voiced stops *b*, *d*, *g*: compare Gaulish *catu-* (battle) with Old Irish *cath* and Welsh *cad*.

(4) Old Celtic *j* and *w* are lost in Irish, but preserved in Brittonic: compare Old Celtic **jewnkos* (young) with Old Irish *óac* (archaic *óéc*) and Welsh *icuanic* (young).

(5) The vowels of accented syllables are better preserved in Goidelic than in Brittonic: compare Gaulish *dānon* (fort) with Old Irish *dún* and Welsh *din*; Gaulish *oinos* (one) with Old Irish *oin*, *óin*, and Welsh Breton *un*.

(6) Owing to the contact with the Romans there were not only many more Latin words introduced into Britain than into Ireland, but the Brythonic languages became much more simplified in their grammatical structure and preserve far less archaic traits than Goidelic.

Differences from Other Indo-European Languages.—While Gaulish syntax does not seem much different from that of the other Indo-European languages, as far as we are able to judge from the few inscriptions, the general character of insular Celtic seems completely different. (1) While the autonomy of the single word seems especially characteristic of Indo-European, it is rather the group of closely connected words that forms the principal unit in insular Celtic. This explains why the same rules which govern the fate of intervocalic consonants or of nasals + consonants are also applied to initial consonants within certain groups of words in accordance with the original endings of preceding words; compare Old Irish *fer cáech* (a blind man), Old Celtic **riros caicos*; genitive *fir chaich*, Old Celtic **riri caici*, where the initial *c* is treated like intervocalic *c* if the preceding noun ended in a vowel. Thus the original endings still exercise their influence upon the initials of a following word, long after the endings themselves have been lost. Without these changes, so-called initial mutations, there would be no such thing as syntax in Celtic. They have taken the place of the original word inflection, which has thus been supplanted by so-called group inflection, characteristic of some non-Indo-European languages, like Basque and most languages of the Caucasus. The same group inflection appears in verbal forms which incorporate not only a pronominal object, a construction also found in some Indo-European languages, but at the same time a pronominal subject as well as relative and local particles; as for example, Old Irish *amal as-i-n-d-hcir-som* (as he says it), from earlier **eks-is-en-ide-e(d)-beret-somos*, literally (in-the-way out-he-in which-here-it-brings-he).

(2) The fixed position of the verb at the head of the sentence which is not obligatory in any other Indo-European language, is likewise found in Berber, Egyptian, and Semitic.

(3) The Indo-European languages are characterized by a highly subjective verb which treats normally all events as actions; they also have developed a nominative case as the distinct expression of the subject as such. In insular Celtic the agent (logical subject) of the action which the verb expresses, very often appears in an impersonal, passive construction, also found in Egyptian, Berber, Basque, and in many Cau-

casian and Arctic languages (Eskimo). Note particularly the passive construction even of the verb *to be*, as in Old Irish *is di Ult(a)ib dom* (it is of the Ulstermen to me = I am an Ulsterman).

(4) The insular Celtic system of tenses and aspects, particularly the use of the progressive (periphrastic) tenses to denote the aspect (also taken over by English), is certainly not Indo-European but has parallels in Basque, Egyptian, and Berber.

(5) There is no present participle, its function being discharged by the verbal noun, as in Egyptian and Berber.

(6) The so-called inflected prepositions (Old Irish *dom*, to me, *duit*, to you, *dó*, to him) have their exact parallel in Berber, Egyptian, and Semitic. Prehistory and anthropology show the existence of more than one pre-Celtic element in the British Isles: remainders of the Paleolithic inhabitants of western Europe, many traces of a widespread Arctic Mesolithic culture, Mediterranean invaders from northwest Africa (the bearers of Megalithic culture) and finally, during the Bronze Age, Dinaric brachycephalic immigrants from Spain, hailing ultimately from the Middle East, the so-called bell-beaker folk. See also CELTIC LITERATURE.

The great importance of Celtic linguistical studies lies in the fact that here we have an excellent chance of studying the effects of race and language blendings. It is at last being realized "that the Celtic world commands one of the chief portals of ingress into the pre-Aryan foreworld, from which it may well be that we modern Europeans have inherited far more than we dream."¹

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JULIUS POKORNY,
Former Professor of Celtic, University of Berlin;
now in Zurich, Switzerland.

CELTIC LITERATURES. Though we have no remains of the rich literature of the continental Celts, our knowledge of their art and their national character, as described by the classical writers, gives us some idea of the literary characteristics and shows that in many respects it must have resembled that of the insular Celts.

The chief characteristics of Celtic literature are as follows:

(1) The Celtic nations stand almost alone in the fact that they did not employ poetry for epic narrative. The verse form was reserved for the use of lyric poetry. Prose was the natural vehicle for Celtic narrative. When the French Arthurian epics became known to the Welsh, they were changed from verse into prose. On the other hand, the prose form of the Teutonic sagas and French romances is due to Celtic influences.

(2) There is no Celtic drama, but the prose epics are often interspersed with dialogues in verse form.

(3) Celtic poetry is frequently deficient in the architectonic quality, in the sense of structural unity. The poets do not seem to have the faculty to produce large, continuous compositions, but devote their attention to the harmonious detail rather than to the whole. In the longer poems or tales, image is added to image, fancy piled on fancy, but we feel the want of any organic progression of thought and feeling. They are masters of detail, just as the Celtic artists were masters in decoration and handicraft, but

¹ John Rhys in *Proceedings of the British Academy* I (1903), p. 60.

did not produce great representative works of art.

(4) The devotion to detail explains why, in so many beautiful poems, we do not have elaborate or sustained description, but rather a succession of impressionistic pictures and images. To the poets the half-said thing is dearest; they avoid the obvious and the commonplace. A thousand years later this "impressionism" would be rediscovered in France; that this happened on old Celtic soil is certainly no mere coincidence. The Celts are distinguished among the Indo-European peoples by high mental excitability, accompanied by quickness and mobility of thought. Also their language shows a tendency to break thought into smaller parts than does any other Indo-European language. These quick transitions of thoughts and feeling, which characterize the Celts, had impressed the Greek and the Latin writers.

(5) Celtic nature poetry stands quite alone in medieval European literature. Nowhere else do we find such a sensitiveness to nature's various moods and the capacity of bringing human moods into relation with those of nature. It is sentimental and highly imaginative, but never rationalistic. Often nature is described with a loving fidelity which has no object but itself.

(6) The irrational plays a far greater part than in other literatures. Celtic literature is full of tales of magic and the supernatural; the distinction between natural and supernatural had not yet been clearly drawn. Dreams and visions belonged to the stock of the poet's repertoire, and even today some of the folk stories are actual daydreams. The Celtic storyteller had a vastly greater power of imagination and a much more subtle sense of the uncanny than the storyteller in other European countries. The fantastic exaggeration found in early epic tales was sometimes done for the fun of the thing, but by no means for this reason alone. The strong sense for the irrational had long been a characteristic of continental Old Celtic art.

(7) Though the Celts appear in their literature as a warlike people, gay and sensuous, fond of bright colors and eager for life, there is, after all, a vestige of truth in the myth of the "Celtic twilight," in which the Celts appeared to the rest of Europe as a result of the forgeries of James Macpherson (q.v.). In the earliest Celtic poems we occasionally find an intense, passionate yearning for that which is not possessed, for dead friends, for vanished youth, for satisfaction which life can never give. But those elegies form merely a small part of the early Celtic literature. Only in modern times has the tragic fate of the Celtic peoples, who often had to struggle for their bare national existence, caused a change. Political persecution and social depression could not be without effect upon the literary production.

(8) While poets of other nations usually endeavor to translate the remote into terms of the present, Celtic poets invariably depict the remote as remote, producing in this way the sense of mystery and atmosphere of glamour found in so many Celtic romances.

Irish Gaelic Literature.—This division of the Celtic literatures is treated in a separate article under the heading **GAELIC LITERATURE**.

Scottish Gaelic Literature.—Until the beginning of the 18th century the literary language of the Scottish Highlands was the Gaelic of Ireland. The classic Gaelic poetry is the same in both

countries. The subjects treated are about identical, since the literature of Scotland in its earlier stages drew its inspiration and themes from the motherland. The official poets and men of learning of the Gaelic chiefs went to Ireland for their bardic training. The family bards occupied an honored position in the social system; they kept alive the pride of race and ministered to it, especially by panegyrics.

We get the first glimpse of a special Scottish Gaelic tradition in the oldest and most precious collection of poems, known as the *Book of the Dean of Lismore*, written between 1512 and 1529 and collected by Sir James Macgregor, dean of Lismore in Argyll. Though the subject matter of the poems does not differ much from the contemporary Irish literature, the curious phonetic orthography and stylistic peculiarities enable us to form a fair idea of the dialects spoken in Scotland. The most important part of the collection consists of 28 *Ossianic Ballads*. Thus the dean's book gives clear evidence that already at that time Ossianic poetry was recited and known in Gaelic Scotland, very similar to the type known from later tradition. The use of the ballad for epic purpose originally was foreign to the Celtic poetic genius; no doubt its adoption was due to Viking influence in both Ireland and Scotland.

Toward the close of the 16th century, owing to the decay of the trained professional poets and of the bardic organization, a new school of poets arose. The complicated syllabic classical meters were abandoned and new meters came into existence. This modern poetry was usually regulated by stress, each line having a fixed number of stressed syllables—in other words, a certain rhythm. The foremost representatives of this new mode were Mary Macleod (in Gaelic, Mairi Nighean Alastair Ruaidh, c.1615–1707) and John Macdonald (Iain Lom, c.1620–1710).

More than 130 poets are mentioned between 1645 and 1830, many of them men of really great ability. Their language was the current Gaelic of their day. While the classic poetry was addressed to the aristocracy, the modern poetry was addressed to the people. The greatest original genius was Alexander Macdonald (Alasdair MacMhaighstir Alasdair, c.1700–1760) who struck an entirely new note in Gaelic literature. In his descriptive poems he gave expression to that intimate love of nature, as found in early Irish lyrics. In 1741 he published the first Gaelic vocabulary, the first book printed in Scottish Gaelic. Other poets of great merit were Duncan Bán MacIntyre (Donnachadh Bán, 1724–1812) and the great satirist, Robert Mackay, called Rob Donn (1714–1778). The greatest writer of hymns and sacred poems was Dugald Buchanan (1716–1768). The poets of the new school were born, not made. Their poetry is spontaneous; it has the notes of freedom and sincerity, and great beauty of form; the style is direct and clear. The poets delight in manly vigor and beauty, in prowess in war and hunt, in singing of festivity and of music. There is no trace of "Celtic mysticism" or of "Celtic gloom," not even in the lyrical outburst which followed the Forty-five (the Jacobite uprising in 1745), when the Gaelic people were left dependent on a foreign—and to them distasteful—culture. The dominant note in it is emphatical personal loyalty to their beloved prince. In the dawn of the 19th century every district in the Highlands still had its native poet,

but today not many bards of high reputation are left.

James Macpherson (1736-1796), the well-known forger of Ossianic ballads, has no place among the Gaelic poets, because his Gaelic texts are mere retranslations from the English and full of offenses against idiom, being written in an unnaturally strained language. Yet he was an Anglo-Celtic poet of real genius and, after all, an heir to the ancient Celtic bards. Though his overflowing sentimentality corresponds rather to the general tendency of the 18th century than to the Celtic character, there is a decided Gaelic atmosphere in his work and his sentimental nature poetry is doubtless an old Celtic heritage. His great mission was to make people aware of the existence of Celtic tradition, and the Ossianic revival led to the diligent collection of Ossianic poetry in the Highlands and the Isles. The effect of this was of lasting importance in the salvation of this tradition from oblivion.

Despite a total absence of printed books, the Scottish Gaels were in possession of a rich oral literature, dating back at least eight or nine centuries, still kept alive and familiar to the people. The ballads, mostly derived from older prose stories, are concerned chiefly with the deeds of the Irish hero Finn and his heroes, the foremost among them being Ossian and Oscar; very often they are represented as fighting against invaders from overseas. Since about the 12th century the Vikings often have taken the place of older supernatural foes. Moreover, the older Irish cycle about the heroes from Ulster is not absent, but it was not popular in Scotland. No less interesting than the Ossianic ballads (and far more important to the folklorists) are the numerous charms and incantations, collected by Alexander Carmichael (1832-1912) in his immortal *Carmina Gadelica*.

Unfortunately there is not much Gaelic prose literature worth mentioning. The whole Gaelic Bible appeared in 1807; the earlier editions of 1767 and 1783 show too much Irish influence. But we have a great amount of valuable Gaelic folk tales published (see *Bibliography*), not to mention various collections of proverbs.

Manx Literature.—There is no early literature extant in Manx. Of the many Ossianic poems known among the Manx people only one fragment (and that possibly of an earlier period) has been preserved. Most of the existing literature of native origin consists of ballads and carols, locally called carvels. Only a small part of these has been published. There is, besides, a fair amount of folklore, tales, and proverbs.

The translated literature is almost entirely of a religious character. The earliest book known to have been written in Manx is a translation of the Book of Common Prayer, written between 1625 and 1630 (but published only in 1895). The first printed book is *The Principles and Duties of Christianity* (1699) by Bishop Thomas Wilson. The complete Old Testament appeared in 1772 and the New Testament in 1775.

Among nonreligious translations may be mentioned a paraphrase of portions of Milton's *Paradise Lost* by Thomas Christian (1794) and *Aesop's Fables* by Edmund Faragher (1901).

Welsh Literature.—Welsh early poetry is found mainly in four manuscripts commonly called *The Four Ancient Books of Wales*, namely the *Black Book of Carmarthen*, the *Book of Aneirin*, the *Book of Taliesin*, and the *Red Book*

of *Hergest*, all written after the close of the 12th century. Most of the poems in these manuscripts are attributed to four poets: Aneirin, Taliesin, Myrddin (the Merlin of romance), and Llywarch Hen. Those are called *cynfeirdd* (early poets). Metrically their work shows the main characteristics of Welsh syllabic verse. The rhythmic effect is attained chiefly by the use of internal rhyme and of consonantal correspondences. The first three poets belong to the "Men of the North," the British tribes who, until the mid-7th century, owned the south of Scotland and the northeast of England. The *Gododin* (*Gododdin*) of Aneirin, a poem on the Battle of Catraeth (probably modern Catterick), about 600 A.D., is not a narrative poem, but rather a succession of lyrical laments on the disastrous effects of the battle. Though largely modernized, the *Gododin* and several historical poems attributed to Taliesin show distinct traces of direct copying from a 9th-century original. It has been claimed on internal evidence that the *Gododin* is actually the work of Aneirin (c.600). The Myrddin poems, as well as his name, are late and spurious. Llywarch Hen is not the author of the poems attributed to him, but merely the chief character of a lost saga, produced about 850 in Powys or mid-Wales. The poems are steeped in magic and have a prevailingly elegiac quality.

The next period, that of the *gogynfeirdd* (rather early poets), from about 1150 to 1350, is the time of the bardic court poetry. The bards were court officials with closely defined duties and recognized privileges. Their tendency to preserve the exclusiveness of their caste by multiplying the difficulties of their craft led to an exaggerated formalism and the substitution of verbal ingenuity for passion and imagination. Yet their poetry often succeeded in expressing not systematically but rather by suggestion the whole gamut of their emotions. Noun is piled on noun and adjective on adjective, so that one must feel their poetry rather than understand it.

The father of modern Welsh poetry is Dafydd (Davydd) ap Gwilym (c.1325-1385),* the greatest poet produced by Wales. He broke the tyranny of the bardic schools and freed the poetic language from the fetters of conventional archaic diction by writing in the ordinary language of his educated countrymen. He introduced popular fresh themes and established the new metrical form called *cywydd*. His love poems are derived from Provençal poetry through the channels opened by the *clerici vagantes* (wandering scholars), but are far more realistic. The highest summit of his poetic art he attains, however, in his nature poems.

Unfortunately the authority of the bardic schools soon re-established the old formal strictness, though the *cywydd* remained and flourished. After centuries of decadence and the final collapse of the bardic organization, the Methodist revival of the 18th century, which produced masterpieces of modern hymnology, and the literary renaissance, which was in strong opposition to it, led to an extraordinary outburst of poetry. Here belongs Ceiriog (pen name of John Ceiriog Hughes, 1832-1887), one of the chief lyric poets of Wales.

From about 1850 the accentual free meters gained more and more ground. The "new poet" school was inaugurated by Sir John Morris-Jones (1864-1929) with his excellent translations from

* Some sources give c.1340-1400.

Heine. W. J. Gruffydd (1881–), one of the first to revolt against the tyrannical puritanism, has written poems of singular beauty. T. Gwynn Jones has shown that the old tradition can answer to any demand made upon it. His translation of Goethe's *Faust* is a masterpiece.

R. Williams Parry and Cynan are among the best. Modern Welsh lyrical poetry occupies an honorable place among the literatures of the great nations of Europe.

The gift for gnomic poetry and fondness for the epigram have been characteristic of Welsh literature since the 12th century. There are hundreds of examples of the *englyn* (a four-line stanza), many of them comparable to the Greek epigram at its best. Among the countless folk songs must be mentioned the anonymous *penhillion* (stanzas for singing to the harp), often quite heart-rending in their perfect simplicity. In these, as in many other poems of the 19th century, we find for the first time a note of melancholy, that "nostalgia of the infinite," due to the hopeless social conditions and the influence of Calvinistic theology, which has often been quite wrongly ascribed to the Celts as such.

There was no Welsh drama until the 19th century, when this genre made a promising start. The interludes or miracle plays of Twm o'r Nant (1729–1810) hardly deserve that name.

Welsh prose begins with the *Laws of Howel* (*Hywel*) *Idda* (10th century). The vast body of Arthurian legend was widely known on the Continent even before Geoffrey of Monmouth wrote in Latin the *History of the Kings of Britain* (1135). The sources of the Arthurian verse epics of the French poet Chrétien de Troyes (1130?–1180) must have been Welsh and Cornish documents as well as spoken narratives. The earliest attempt at turning prose to artistic purposes is found in the *Four Branches of the Mabinogi*, preserved in the *White Book of Rhydderch* (c.1175). The first four tales (forming the *Mabinnion* proper) preserve Old British mythical traditions, partly influenced by Irish mythology; the others are Old British tales, referring to Roman times. British Arthurian tales, and translations or adaptations of Norman French originals. The translation of the Welsh Bible (1588) laid the foundation for modern Welsh prose. The novels of Daniel Owen (1836–1895) are not much inferior to the work of Dickens. The short stories of Kate Roberts (1891–) and the novels of T. Rowland Hughes (1903–1949) are real works of genius.

More is printed in Welsh—in books, papers, and magazines—than in all the other Celtic languages together. Methodism has saved the Welsh language, but has killed much of the old folk culture of Wales, which in many instances goes back to Megalithic times.

Cornish Literature.—Though the preserved remains of nonreligious literature in Cornish are very scanty, there must have existed a large amount of Old Celtic legends in Cornwall during the Middle Ages. Arthur's treacherous nephew Modret bears a purely Cornish name; in the story of Arthur, Cornwall plays a very important part. Similarly the topography of the *Tristan* saga in the sources of the Anglo-Norman writer Bérout is predominantly Cornish, as shown by J. Loth (*Revue celtique*, 33:258–310 [1912]). The form of many Celtic names in the French epics shows that they must ascend to written Cornish and Welsh sources. There cannot be

much doubt that the world owes to Cornwall and Wales the *Matter of Britain*. Owing to the Norman Conquest, Cornwall (where the French encountered a Celtic population dominated by an English aristocracy) grew to be a trilingual country, so that it is probably to Cornwall and not to Brittany that we owe the transmission of the Celtic legends to the Continent.

Unfortunately the only nonreligious literary remains are a few Cornish conversations, some songs, proverbs and epigrams, and a folk tale, the story of John of Chy-an-Hur (*The Ram's House*), the plot of which is well known in Ireland and elsewhere. Apart from a long poem on the Passion, the religious literature consists chiefly of mystery plays of learned origin and imitated from English sources. Furthermore, there are fragments of translations, such as chapters of Scripture, the Lord's Prayer, and the Commandments. When the Reformation began, neither the Prayer Book nor the Scriptures had been translated into Cornish; and when the Methodist movement came, it was too late. Some enthusiasts lately have attempted a kind of revival of Cornish, which even has produced some fine lyrics and a mystery play.

Breton Literature.—The earliest piece of connected Breton has been preserved in a manuscript of the 14th century. It seems to be a fragment of a love song, similar to the contemporary French chansonette. No other examples of the rich Breton poetry of the Middle Ages have been preserved. The earliest Breton printed work, a Breton-Latin-French dictionary, the *Catholicon* by Jean Lagadeuc, was published in 1499. French seems to have been the language of the aristocracy and the medium of culture; hence the oldest texts are either translated or imitated from French. The early literature is almost exclusively religious, such as *The Hours in Latin and in Breton* (1486) and *The Mirror of Death* (1519).

The bulk of Breton literature before the 19th century consists of mysteries and miracle plays. Brittany is the only Celtic land where the theater, though not of native growth and only introduced from France, has met with an immense popular favor. Upwards of 150 Breton mystery plays are known to exist. The oldest, the *Life of St. Nonn*, belongs to the end of the 15th century and is modeled on the Latin life. The mysteries were adaptations mostly from French or Latin and are full of French words. From the 18th century we also find plays dealing with romances of chivalry, like the *Tragedy of the Four Sons of Aymon* (of which no less than 15,000 copies were sold), *Huon de Bordeaux*, and *Robert the Devil*. Their subject matter is likewise taken from French sources and their chief interest lies in the fact that they are the last creations of the medieval theater.

Only the 19th century brought an original Breton literature. The movement was led by Jean François Le Gonidec (1775–1838), the author of the first Breton translation of the Bible (1868) and of the first scientific Breton grammar, *Grammaire cello-bretonne* (1807), and an excellent dictionary (1821). It caused ardent patriots to endeavor to create a national literature. At about the same time, the attention of the whole world of letters was directed to Brittany, when Hersart de la Villemarqué (1815–1895) published his famous collection *Barsas Breiz* (*The Poetry of Brittany*) in 1839. The publication of this work gave rise to a protracted and heated discussion, which is almost as famous as that caused by Mac-

pherson's Ossian forgeries. Today we know that he had transformed the material which he had collected, eliminating anything which he believed to be crude and gross. He transferred modern poems to medieval times, rearranged others, and composed some himself. But at least he had a fluent command of Breton and his book is not only a great and really beautiful work of art, but also in linguistic respect much superior to that of Macpherson. His poems gave, just as in Scotland, the signal for a serious study of the popular Breton ballads, legends, and folk tales which form the real literature of Brittany. The most famous collections we owe to F. M. Luzel (1821-1895) and Anatole Le Braz (1859-1926).

It is usual to divide the popular Breton poetry into *gwerziou* and *soniou*. The *gwerziou* (complaints) are short ballads or complaints, or village tales in verse of a highly dramatic quality and usually of tragic interest. The *soniou* (songs) consist of love songs, satires, carols, sailors' songs, and sometimes show traces of French influence. The Breton folk tales and legends are extremely valuable from the folkloristic point of view and show some very archaic traits. In 1839 (when Villemarqué published his *Barsas Breiz*) there appeared the first book of Prosper Proux (1811-1873), *Kanaouennou eur C'hernewad* (*Poems of a Man from Cornouailles*), one of the few original Breton poets of the 19th century. Another great poet of that time was Auguste Brizeux (1803-1858), the author of *Telen Arvor* (*The Harp of Brittany*).

A new important literary movement started in the 20th century. It was inaugurated by the work of linguistic specialists, like Émile Ernault (1825-1938), François Vallée (Abhervé) and René le Roux (Meven Mordiern). In 1918 there came into being a small circle of intellectual writers, whose work found expression in the pages of the journal *Gwalarn* (*The Northwest*), which appeared from 1925 to 1944, to be continued from 1946 by *Al Liamm* (*The Bond*). Already in 1921 a small volume of poetry had been published, written in the Vannes dialect, by Jean Pierre Calloc'h (d. 1917) under the title *War an Daoulén* (*A Genoux*), published with a French translation. His poetry is mystic and Catholic and completely free from the platitudes of his contemporaries. Thence a new poetry came into existence, worthy of the best which other countries have produced. Among the younger poets may be mentioned: Xavier de Langlais, Maodez Glanndour, Roparz Hémon, and many others. Some of the finest examples of Celtic nature poetry are found among the poems of Roparz Er Mason: *Chal ha Dichal* (*Flood and Ebb-tide*), published with a French version in 1943.

Quite a new feature in Breton literature is the short stories of Jakez Riou, Roparz Hémon, and Kenan Kongar. The novel *Itron Varia Garmes* (*Our Lady of Carmes*) by Youenn Drezen has been translated into French under the title *Notre-Dame Bigoudenne*.

A modern theater is being created by the work of Tangi Malmanche, Xavier de Langlais, and Roparz Hémon. Some of their work almost equals that of the Anglo-Irish poets, such as Yeats and Synge. The patriotic work of all those young idealists is the more to be admired, because they have no help whatever from any official circles. The French government is very hostile to all their efforts and tolerates the Breton language neither in public schools nor in public insti-

tutions, fearing a resurgence of the old separatist movement.

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JULIUS POKORNY,
Former Professor of Celtic, University of Berlin;
now in Zurich, Switzerland.

CELTIC PEOPLES. The term Celts denotes groups of peoples who spoke or still speak a Celtic language. The ancient Greek writers used the name Κελτοί (Latin *Celtae*) as a general racial designation of those peoples. It was probably generalized from the name of the small groups of Celts with whom the Greeks first came in contact, the stem *Celt-* occurring frequently in ancient Spain. At the meaning we can only guess, for there are various roots of the form *kcl-* (such as to raise, to beat). From another root *gal-*, probably related to Old Irish *gal* (courage), are derived the names *Galli*

(Gauls), a later rival to the old name of Celts, and Γαλάται (Galatians), originally the name of the Celtic invaders of Macedonia and Greece.

Race.—Since language is the chief criterion by which we can distinguish the Celts from other European peoples, there can be, of course, no question of a "Celtic race." Yet the problem of race must not be discarded altogether. Greek and Latin writers, when speaking of the Celts, described them as a tall, fair-haired, blue-eyed, white-skinned people. It has been demonstrated that it was only these Celts who attracted the attention of the classical writers (accustomed to an almost uniformly dark-haired and dark-eyed population), and that they naturally would seize upon the points of distinction and would regard them as generally typical. We also know that some of the Gauls were less fair than the rest. But on the other hand, the ancients did not distinguish between Celts and Teutons before Caesar (100-44 B.C.) and the earliest Celtic graves in the basin of the Marne, in Lorraine and Franche Comté, as well as the Early Iron Age graves in England, contain almost without exception tall, dolichocephalic skeletons, which point clearly to a Nordic origin. In the earliest Irish sagas most of the heroes and princes are described as fair-haired and blue-eyed. All this shows beyond doubt that the upper classes must have belonged to the Nordic race. Since we know that before the Nordic invasion the greater part of the Celtic home in the south of Germany and in Switzerland had been populated chiefly by Alpine and Dinaric races, we should expect a far greater percentage of Alpine roundheads in the British Isles, if these had formed a considerable part of the Celtic warrior caste. The predominant Nordic character of the invading Celts in the British Isles, however, may also be due to the fact that the starting point of those invasions comprised the regions on the lower Rhine, where the Nordic element was far stronger than farther south.

Home.—The ancestral home of the Celts is probably to be sought in southwest Germany (with the Swiss plateau), and in eastern France. Archaeologically it is manifest in the Western Bronze Age tumulus culture (1500-1200 B.C.), formed on a substratum of Neolithic and ultimately Mesolithic stocks by the addition of roundheaded Dinaric (bell-beaker) folk from the southwest (Spain), and finally Indo-Europeanized by the longheaded Nordic battle-ax warriors (corded-ware people) from central Germany (c. 2700 B.C.).

Urnfield Invasion.—These early Celts were overrun in the 12th century B.C. by the Urnfield people who ultimately came from the middle Danube. (Urnfield refers to the custom of cremation burial in urns.) But eventually the older population reasserted itself and finally absorbed its conquerors. The language of this Urnfield people may perhaps be called Central-Indo-European or Veneto-Illyrian. The Urnfield culture was genealogically connected with the Lusatian (Lausitz) culture of the northern Veneti, but had absorbed on the middle Danube and elsewhere northern Illyrian elements. Its language is merely to be inferred from place and river names, which extend from Hungary to as far west as Spain and the British Isles. These names are clearly Indo-European, but they are neither Celtic nor Italic nor Germanic. They seem, however, to form a kind of link between

Celtic and Baltic. Many western European river names are strangely identical with Baltic (Lithuanian and Lettish) river names. Their geographical distribution seems to show that the spread of the Urnfield culture in the Late Bronze Age was due not merely to cultural influences, but also to actual conquest. The Aquitanian tribal name *Camponi* corresponds to the Pannonian place name *Campona* (compare Lithuanian *kam̃pas*, corner); the Greek name of the north Spanish plain Κοπλάνιον stands for **komplānion* (compare Latin *plānus*; Old Irish *lán*, full); in Britain, the old name of Richborough: *Rut-upiæ* contains *upiā* (river), also found in Lithuanian *upė*, from **upiā* (river).

Early Migration.—Some of the Urnfield invaders spread farther west beyond the Celtic ancestral home, probably carrying early Celtic elements along with them, just as 1,500 years later Iranian Alani were wandering with Teutonic Vandals from Hungary to Portugal. Those first Indo-European conquerors reached, in the 10th century B.C., southwestern France, northern Spain (over the eastern Pyrenees), and (from the lower Rhine) the British Isles. The first great phase of the Early Iron Age in central Europe, known as the Western Hallstatt culture (originating after the absorption of the Urnfield elements by the Proto-Celtic tumulus culture in the 10th century B.C.), can safely be called Celtic. Under the pressure of the Teutons, who, from the 8th century B.C. onward, penetrated westward and drove the Celts step by step nearer to the Rhine, the Hallstatt Celts on the lower Rhine followed the same route as their predecessors, the Urnfield people.

Northern Branch.—The northern branch crossed the English Channel and brought during the Late Hallstatt period (probably in the 7th century B.C.) purely Celtic invaders to Britain (British Iron Age A).

Southern Branch.—The southern branch moved toward Spain, crossing the western Pyrenees. This late Hallstatt invasion of Spain led to a Celtic conquest of all the northwest of the peninsula, including the northeast part of the central plateau, the country of the Celtiberians in a strict sense. The term Celtiberians denotes Celts who, from the 3d century B.C., fell more and more under the influence of the Iberians. Their numerous inscriptions, though written with Iberic letters, are almost pure Celtic of the archaic *Qu*-type and represent the earliest traces of the Goidelic (Gaelic) dialect, as found in Ireland and Scotland—in fact the only certain examples of Goidelic on the Continent.

These Spanish Celts were the first Celts who became known to the Greeks. The earliest reference to them is found in Rufus Festus Avienus' *Ora Maritima* (c.385 A.D.), which is drawn from a Greek original, composed probably in the 6th century B.C. The well-known passage in Herodotus (book ii: 33, 3) in which he mentions the Celts as the neighbors of the Portuguese Cynesians, was taken from Hecataeus of Miletus (c.500 B.C.). Therefore history itself shows that the Celtic invasion of Spain must have occurred about 600 B.C. The archaic character of the Celtic occupation of the Iberian Peninsula is also shown by the place names with *-briga* (fortress, the Celtic equivalent of German *Burg*), which

The asterisk (*) indicates that this particular word form is conjectured and reconstructed.

are here more frequent than anywhere else and indicate warlike settlements in a hostile country. Names with *-magus* (plain) and *-ialum* (clearing), which are very frequent in Gaul, do not occur on Iberian soil.

Later Migration.—The Western Hallstatt period (1000–500 B.C.) was followed by the La Tène period (500–1 B.C.), the Late Iron Age in Celtic lands. It was a mere cultural development, owing to the spread of classical ideas and fashions from Italy and southern France. The growing wealth in southwest Germany and eastern France led to a constant increase of the population and subsequently, about 425 B.C., there began the great expansion of the Celts all over middle, western, and eastern Europe. All these La Tène Celts belonged to the so-called *P*-group which changed Early Celtic *qu* to *p* (Goidelic *equos*, horse; Gaulish *epos*).

Western Branch.—Spain was probably invaded by *P*-Celts during the period of La Tène II (250–100 B.C.), though this fact is not universally acknowledged. The whole of France now became Celticized. The Hallstatt invasion into Britain was followed in the 3d century B.C. by a La Tène invasion (British Iron Age B). With the landing of Belgic tribes in 75 and 50 B.C., the Celticization of Britain was complete.

According to Caesar, the ancient Belgae were mostly of Teutonic origin. Their name is to be connected with Old Irish *bolgaid* (swells) and Old High German *belgan* (to swell). Linguistically, however, they were completely Celticized in historical times. According to Pedro Bosch-Gimpera (see *Bibliography*) they not only invaded Britain in the 1st century B.C., but also had wandered in the 6th century B.C. through western France into Spain—a theory which, however, remains to be proved.

Ireland.—The Celtic invasions of Ireland present a very difficult problem. All we can say is that there must be some connection between the Goidelic settlements of Spain and those of Ireland. Either both came from the same ancestral home on the lower Rhine (in which case we must assume an invasion by way of Britain, not far removed in date from the Spanish Hallstatt invasion) or, perhaps, the Goidels reached Ireland directly from Spain or by way of Brittany along the Atlantic sea route, by which the megalith builders had come from Spain to Ireland about 2500 B.C. That we know of no Goidelic traces in Britain going back to the 7th century B.C. is not surprising if we consider that Brythonic and Goidelic were still very close to one another even in St. Patrick's time (389?–?461 A.D.). At any rate, the last important Celtic infiltration into Ireland about the middle of the 2d century A.D. must have reached the north of the island through Britain. It brought late La Tène elements from Yorkshire, ultimately going back to the Marne. This Brythonic element in Irish, however, was soon absorbed and became completely assimilated to the older Goidelic population.

Southern Branch.—Other La Tène Celts from 400 B.C. onward conquered the whole of Upper Italy, sacking Rome about 390, and penetrating as far as Campania and Apulia. About the same time these warlike peoples conquered the remainder of middle and southern Germany (hitherto in possession of the eastern Urnfield peoples), the Alpine forelands along the Danube, Bohemia, Moravia, Silesia, and Hungary. As early as 350 B.C. they appeared on the shores of the

Adriatic Sea, sending envoys in 335 to the camp of Alexander. Shortly afterward they conquered Illyria proper and Thrace. In 279 they invaded Greece and looted Delphi. Passing the Hellespont in 278–277, they founded the Celtic empire of Galatia. It was to the descendants of those Celts in Asia Minor that St. Paul addressed his Epistle to the Galatians. Others went along the coast of the Black Sea as far as the Sea of Azov, the extreme limit of their eastern advance.

Conclusion.—In the modern sense of the word, there never was a Celtic empire. The Celts neither formed a political unity nor possessed a strongly centralized government. Hence, almost everywhere they fell an easy prey to the Teutons and the Romans. The genius of the Celtic peoples has been more remarkable for its creative imagination and a certain love for the irrational than for its abilities for organization. Their poetic and musical inclination was so deeply rooted that they never have been remarkable in architecture, sculpture, representative painting, or in any manifestations in the abstract. The large admixture of the pre-Celtic Mediterranean element in Great Britain and Ireland, where they found their last refuge from stronger races, has still strengthened these characteristic traits. Particularly in Ireland the Megalithic civilization of the Neolithic Age may be said to be still a living force. But the descriptions of the continental Celts which we possess from Greek and Latin sources still hold good. They all emphasize the Celtic love of fighting, daring, and adventure, their imagination, loquacity, and religiosity. Though they have not succeeded in leaving permanent political traces, their influence on Western civilization is by no means to be despised. It goes deeper than many of us are likely to believe. See also **ARCHAEOLOGY; CELTIC LANGUAGES; CELTIC LITERATURE.**

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JULIUS POKORNY,
Former Professor of Celtic, University of Berlin;
now in Zurich, Switzerland.

CELTIC RENAISSANCE. See **IRISH LITERARY REVIVAL.**

CELTIS, tsél'tis, or **CELTES**, tsél'tés, sél'téz, **Conradus**, (original name KONRAD PICKEL); German humanist and poet: b. Wipfeld, near Schweinfurt, Germany, Feb. 1, 1459; d. Vienna, Austria, Feb. 4, 1508.

He studied under Agricola in Heidelberg, then taught in Erfurt, Rostock, and Leipzig. He was professor of rhetoric and poetry at Ingolstadt (1492-1497), and at Vienna (1497-1508). He promoted the study of Latin and Greek and systematized the methods of teaching them; discovered Peutinger's Table (q.v.), and the Latin plays of Roswitha (q.v.). He was librarian to Maximilian I, and the first poet laureate of Germany.

His most important work was *Ars Versificandi et Carminum* (1486).

CELTIS, sĕl'tis, a genus of trees of the natural order Ulmaceae, closely related to the elm. *C. australis* is the nettle-tree (q.v.).

CEMENT. In modern parlance, the term "cement" refers to any material that is used as a bonding agent for causing diverse materials to adhere. Many of these agents are described elsewhere under such designations as asphalt, glue, mucilage, plastics, putty, and solder (qq.v.). The application of hydraulic cements in the construction and road-building industries has become so extensive, however, that the unmodified term "cement" now refers almost exclusively to those products.

A hydraulic cement is a material that forms a bond, as between blocks of stone, by virtue of a chemical reaction with water, the product of such reaction being a hard stonelike substance which from the time of its formation is resistant to disintegration in water. Many combinations of the mineral oxides would qualify as hydraulic cements but cannot compete in ordinary construction because of their cost. This restriction limits the field to specific combinations consisting for the most part of silicates and aluminates of lime. Three classes have been developed commercially: natural cements (including hydraulic limes), aluminous cements, and portland cements. Each of these classes has been modified in various ways, either by limiting compositions, by blending with other materials, or by the introduction of admixtures. Various names are given to these products, some of which disclose their nature and others of which are copyrighted trade names.

Natural Cement.—When a pure limestone (calcium carbonate) is calcined, the resulting quicklime (calcium oxide) slakes rapidly in water with the evolution of considerable heat, and the product (calcium hydroxide) forms a putty that does not set under water. Its use as a plaster or a mortar (the bonding agent mixed with water and sand) is dependent on interaction with the carbon dioxide in the air, resulting in the formation of a moderately hard bond of calcium carbonate. The calcined product of such a limestone is called fat or high-calcium lime. But when the limestone contains up to 25 per cent of argillaceous material, such as clay or shale, the calcined product reacts slowly with water; there is no rapid evolution of heat; and a hard product is formed that does not disintegrate under water. The calcined product of such a limestone is called hydraulic lime or natural cement. The composition varies from a relatively low (10 to 20 per cent) silica and alumina content to a relatively high one (20 to 35 per cent). There may be present also 10 to 25 per cent of magnesia. The higher grades, giving the higher cementing values, usually carry the designation "natural cement."

These products are made by calcining at temperatures below sintering, lumps of naturally occurring limestones that contain the argillaceous material indicated.

The amount of hydraulic lime and natural cement produced in the United States in 1952 was about 3 million barrels. (The barrel is the standard unit of weight for hydraulic cements in the United States. A barrel of cement is 371 pounds, or four bags of 94 pounds each.) Much of this was used either as an admixture with portland cement or as an ingredient of masonry cements. The term masonry cement applies however, not to any particular class of cement but to the use for which the material is made, that is, as a mortar to bond brick or stone.

Aluminous Cement.—Aluminous or high alumina cements are made by heating a mixture of limestone and bauxite until molten. The finely ground product, consisting principally of aluminates of lime, has the property of reacting rapidly with water to form a hard mass that is resistant to water and sulphate solutions. Its rapid rate of hardening, faster than ordinary portland cement, makes it suitable in the placing of highway and street intersections where traffic diversion must be as brief as possible. Its resistance to salt action has led to its use in some severe exposures. A further application of importance is in the insulation of furnaces where high temperatures are encountered. In the United States, aluminous cement is made by one company under the trade name of "Lunnite." In France and England it is known as "Ciment Fondu."

PORTLAND CEMENT

The name "portland cement" was given in 1824 by Joseph Aspdin, a bricklayer of Leeds, England, to a hydraulic lime that he patented, because when set with water and sand it resembled a natural limestone quarried on the Isle of Portland in England. At about the same period it was discovered that the pulverized nodules of material, called grappiers, which occasionally became sintered on burning hydraulic lime, and which were formerly discarded, produced a cement of much higher quality than that obtained from the unsintered material. This fact was firmly established by I. C. Johnson in 1845, and the name "portland cement" has since then been applied solely to the cement made from the sintered material. This period marks the real beginning of the portland cement industry.

During the past hundred odd years, the product has won universal acceptance and the demands of the engineers have imposed constantly rising standards of quality. Extensive researches under way in nearly every country have produced precise information on the relationship between the nature of the cement and its performance in service. The cement manufacturing plant has evolved from a roadside kiln to a vast assemblage of machinery where mountains are converted into the bonding material of concrete.

The first portland cement to be made in the United States was produced by David Saylor at Coplay, Pa., in 1871, in vertical kilns somewhat similar to those used for burning lime. The increasing demand for both quantity and quality led to the introduction in 1899 of the rotary kiln. This kiln had been invented by Frederick Ransome in England in 1885, but had not been enthusiastically received there. From the turn of the century, the production of natural cement in



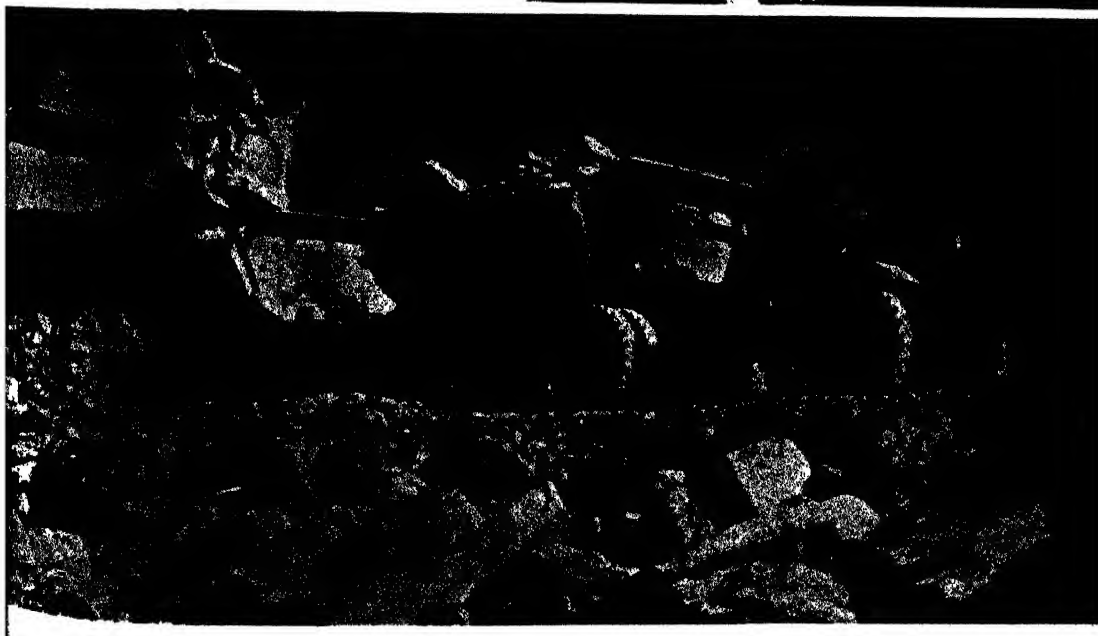
Above: The first step in the manufacture of cement is to blast thousands of tons of stone from the face of a limestone quarry. Sometimes 400,000 tons of rock are dislodged in a single blast.

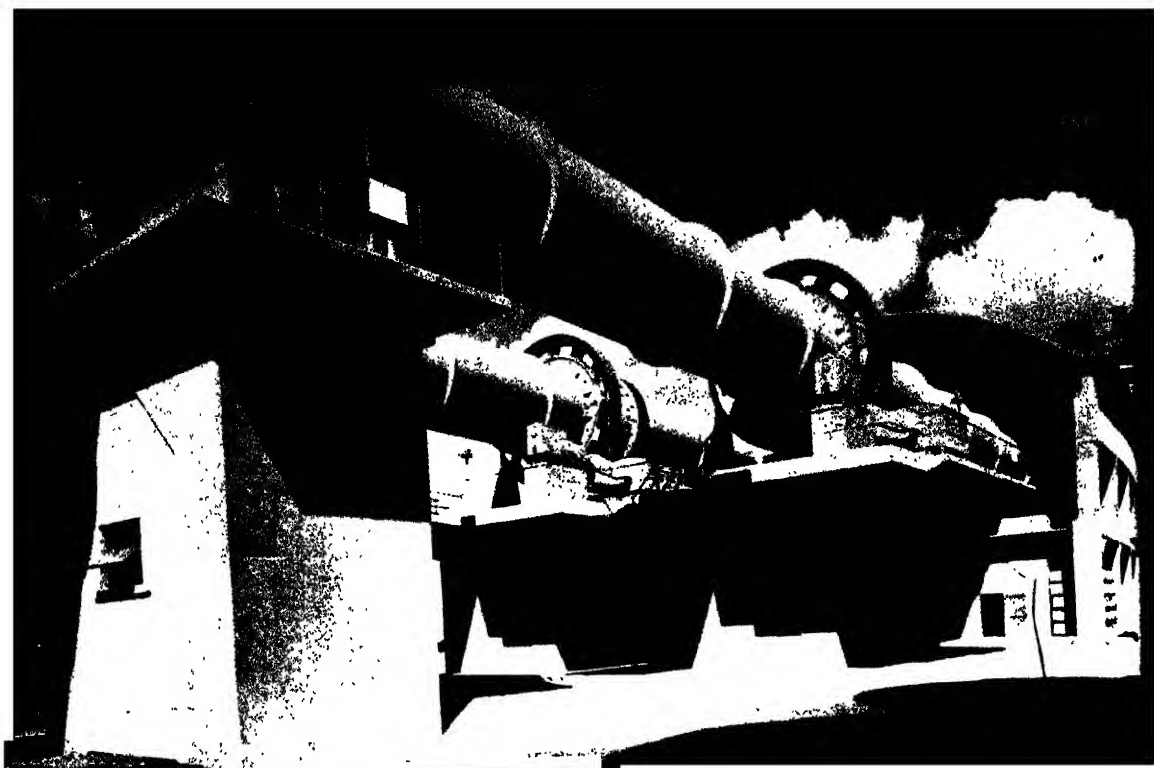
CEMENT

Below: After the blast, the broken rock is loaded into trucks and taken to the mill for the first crushing operation.

Right: Limestone, gypsum, clinkers and other materials are kept in large storage bins, filled or emptied by traveling cranes.

Portland Cement Association





Above: The climax of the manufacturing of cement takes place in the rotary cement kiln, a steel cylinder sometimes 12 feet or more in diameter. If placed on end, an average-sized kiln would equal a 40-story building in height.



Left: The worker is looking into one end of the rotary cement kiln, where the raw materials are subjected to heat of about 2,700° F. The heat transforms the materials into marble-sized balls or clinkers.

Bottom left: After the clinkers have been ground to a fine powder in two operations, an automatic packing machine is used to put the finished product into 94-pound bags.



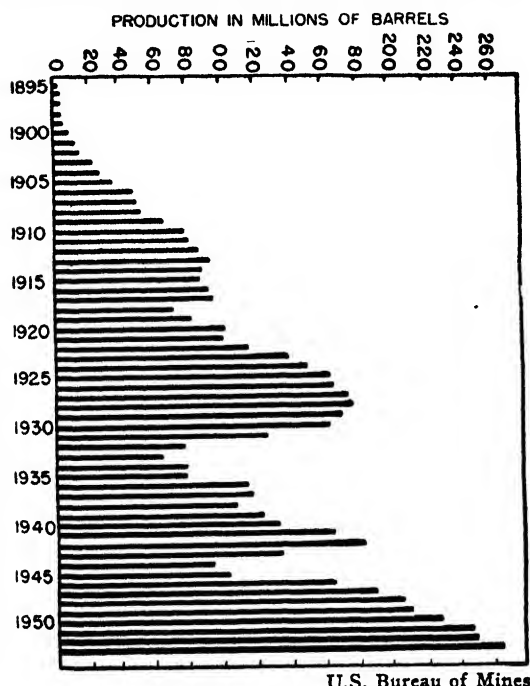
Below: Finished cement is kept in large storage silos.

Portland Cement Association



the United States has declined from its peak of nearly 10 million barrels and the production of portland cement has assumed gigantic proportions, rising from 8 million barrels in 1900 to 264 million barrels in 1953.

In addition to the standard types of portland cement, described below, many modifications have been manufactured. Thus, white portland cement is made for special architectural uses and differs from regular portland cement chiefly in having a very low content of ferric oxide. Oil well cement is made for sealing oil wells and so must be slow-setting and able to resist high temperatures and pressures. The substitution of some iron oxide for clay has been found to improve the resistance to sulphate waters, and such cements are manufactured under the names of Ferrari and iron-ore cement. Most important of the modified portland cements are the slag and pozzolanic cements which are made by inter-



Production of portland cement in the United States, 1895 through 1953.

grinding from 15 to 85 per cent of granulated blast furnace slag or pozzolanic material with the portland cement clinker. In some cases, no portland cement clinker at all is used, but only slag and lime or slag and anhydrite.

Pozzolana was named for a volcanic tuff from the neighborhood of Vesuvius in Italy. The Romans found it valuable in improving the quality of mortars used in their building operations. The name is now given to a variety of naturally occurring materials such as volcanic ash, trass, Santorin earth, and pumicite; and artificially prepared materials such as burned clays, or diatomaceous earth, that have the capacity to combine in water with lime to form a calcium silicate. The use of slag and pozzolana, though common in Europe, has not made appreciable headway in the United States.

Manufacture.—The raw materials of portland cement consist principally of limestone or some other lime-containing material such as

marl, chalk, or shells; and clay or shale or some other argillaceous material such as ashes or slag. The severity of the chemical restrictions is such that calcium oxide, silica, alumina, and ferric oxide must be present within narrowly defined limits, and other constituents, such as magnesia and alkalies, must not exceed specified limits. These restrictions necessitate at times the introduction of other types of rock besides those immediately available, such as a high-calcium limestone, sandstone, or iron ore. On other locations it is sometimes necessary that the available material be beneficiated, as by flotation, to remove excessive amounts of silica, iron oxide, carbon, magnesia, alumina, or alkalies.

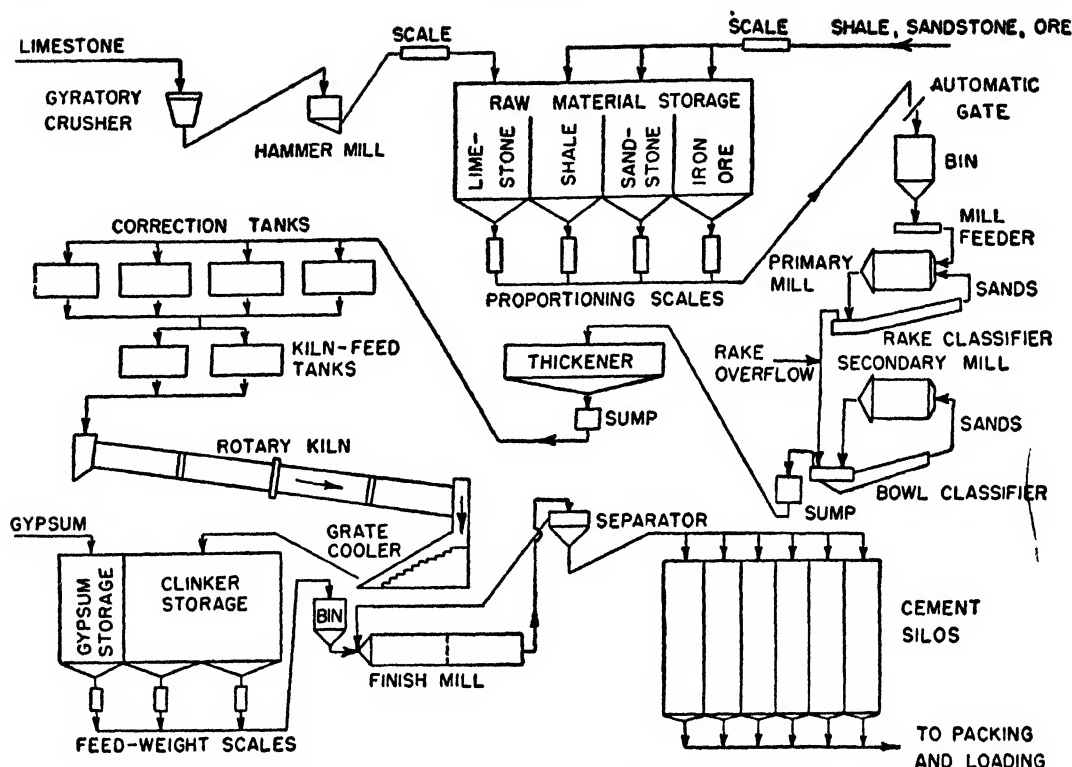
All raw materials must be ground to an impalpable powder and intimately mixed before burning. In a modern cement plant this is a prodigious task, for the rock has first to be blasted out of the mountain, then fed into a giant crusher that takes blocks as large as a grand piano, then broken and hammered and pulverized to the fineness of flour. But this is not all, for the clay or shale and other materials must be thoroughly mixed with the lime rock. Blending of the rock may begin in the quarry and continue as the raw materials flow into each crusher or mill. In the *dry process*, all grinding and blending operations are done with dry materials and the final mixing is accomplished chiefly in the grinding mills. In the *wet process*, the final grinding and blending are brought about in a water slurry, and the mixing is accomplished both in the grinding mills and by stirring in large vats. In both processes, rigid control of the composition of the final kiln feed is attained through chemical analyses made on the raw materials at various stages of the operation, and the subsequent measured blending of mixtures to attain the required composition.

The water is partially removed from slurries by various processes: by gravity settling of the solids in a thickener; by filtration of the water through canvas-covered rotating drums the interiors of which are under reduced pressure; and by evaporation of the water in various kinds of heat exchangers. Often, however, the slurry is fed directly into the kilns and the water is removed by evaporation aided by chains or baffle plates inserted in the back ends of the kilns.

The rotary kiln has completely replaced the vertical or shaft kiln in the United States; the present size varies from 60 to 500 feet in length and from 6 to 15 feet in diameter; the capacity, from 200 to 4,000 barrels a day. The kiln is set at an inclination of about one half inch per foot and rotated at a speed of between 30 and 90 revolutions per hour, causing the load to work its way downward toward the discharge end. There heat is introduced, usually by a blast of ignited powdered coal and air, or less commonly with fuel oil or gas. During passage of the mixture down the length of the kiln, several reactions take place at various temperature levels. These may be classified as: (1) evaporation of water; (2) decarbonation of limestone and magnesite; (3) sintering of part of the charge; and (4) interaction to form silicates or aluminates.

The liquid that forms during the burning process causes the charge to agglomerate into nodules of various sizes, usually one quarter to one inch in diameter, and characteristically black, glistening and hard. This material is known as portland cement clinker. The charge drops from the

CEMENT



Typical flow sheet of wet process portland cement plant.

end of the kiln into some form of cooler and is then ground, usually with 4 to 5 per cent of gypsum (hydrous calcium sulphate), to a powder so fine that most of it will pass through a sieve that will retain water; more specifically, the fineness is specified by a minimum average surface area of 1,600 to 1,800 square centimeters per gram, depending on the type of cement being made. The purpose of the gypsum is to cause a grout of the cement with water and aggregate (as fresh concrete mix) to remain fluid and workable over a period of several hours. Without the addition of gypsum the grout might set before it had been properly placed in the forms.

In Europe the shaft or vertical kiln is still extensively used because it can be operated with greater fuel economy than the rotary kiln. It is claimed that new improvements have been made that give the shaft kiln a competitive status with the rotary kiln with respect to uniformity and quality of clinker produced. A sinter-grate kiln also is in use in which the nodulized charge containing coal or coke is burned on a travelling grate, and ignition is produced by a downblast of burning oil, and continued by drawing hot air down through the moving charge by means of an exhaust fan.

Composition.—Research on the minerals from which portland cement is made has revealed the nature of the compounds that are formed by subjecting any mixture of cement raw materials to clinkering temperatures. With that information it has been possible to design mixtures for the production of cements with various desired properties. Thus five types of portland cement are now included in the standard specifications of the American Society for Testing Materials and the Federal Specifications Board. These are:

Type I: for use in general concrete construc-

tion where the special properties specified for Types II, III, IV, and V are not required.

Type II: for use in general concrete construction exposed to moderate sulphate action or where moderate heat of hydration is required.

Type III: for use where high early strength is required.

Type IV: for use where low heat of hydration is required.

Type V: for use where high sulphate resistance is required.

Each of the above types of portland cement may be obtained either with or without the presence of an agent by which air will be entrained in the paste when the cement is mixed with water and aggregate. The purpose of the entrained air is to improve the durability of the concrete, especially under exposure where cycles of freezing and thawing are to be encountered.

The standard specifications are designed to assure the user of the cement that certain standards of quality will be attained when the cement is used in accordance with recognized good practice. These qualities are largely determined by the presence in the cement of definite amounts of certain compounds which impart the dominant characteristics to the concrete. The table on the following page indicates typical principal oxide compositions of a number of cements.

The principal compounds of portland cement, formed by the reactions in the kiln, are the following:

Tricalcium silicate ($3\text{CaO} \cdot \text{SiO}_2$), which is chiefly responsible for initial set and early strength of the cement-water paste.

Dicalcium silicate ($2\text{CaO} \cdot \text{SiO}_2$), which hardens slowly but contributes notably to strength at ages over one month.

Tricalcium aluminate ($3\text{CaO} \cdot \text{Al}_2\text{O}_3$), which

	Silica SiO ₂	Alumina Al ₂ O ₃	Ferric Oxide Fe ₂ O ₃	Lime CaO	Magnesia MgO	Insoluble
Portland Type I	21.3	6.0	2.7	63.2	2.9	0.2
Portland Type II	22.3	4.7	4.3	63.1	2.5	0.1
Portland Type III	20.4	5.9	3.1	64.3	2.0	0.2
Portland Type IV	24.3	4.3	4.1	62.2	1.8	0.2
Portland Type V	25.0	3.4	2.8	64.1	1.9	0.2
Portland white cement	25.5	5.9	0.6	65.0	1.1	..
Natural cement	27.8	5.5	4.3	35.6	21.2	..
Aluminous cement	5.3	39.8	14.6	33.5	1.3	4.8
Pozzolan cement	26.0	6.9	3.6	52.3	4.2	9.4

liberates a large amount of heat during the first few days of hardening, and is rapidly attacked by sulphate solutions.

The iron-containing phase (a solid solution approaching the composition $4\text{CaO} \cdot \text{Al}_2\text{O}_3 \cdot \text{Fe}_2\text{O}_3$), which is valuable as a flux in manufacture.

Magnesia (MgO) which, if present in excessive amount, may cause expansion of structures exposed to moisture after a number of years.

Calcium sulphate (CaSO_4), which is interground with the clinker to control the rate of setting of the cement-water paste.

Free lime (CaO), which results from incomplete reaction in the kiln, and if present in amounts over 2 or 3 per cent may cause unsoundness and expansion in the cement paste.

From the above account it will be seen that the amounts of the several compounds present in a cement will determine many of the properties of a concrete made therefrom. The following table gives typical principal compound compositions of the five standard types of portland cement:

	$3\text{CaO} \cdot \text{SiO}_2$	$2\text{CaO} \cdot \text{SiO}_2$	$3\text{CaO} \cdot \text{Al}_2\text{O}_3$	$4\text{CaO} \cdot \text{Al}_2\text{O}_3 \cdot \text{Fe}_2\text{O}_3$	CaSO_4	MgO	Free CaO
Type I	45	27	11	8	3.1	2.9	0.5
Type II	44	31	5	13	2.8	2.5	0.4
Type III	53	19	11		4.0	2.0	0.7
Type IV	28	49	4	12	3.2	1.8	0.2
Type V	38	43	4	9	2.7	1.9	0.5

Utilization.—Portland cement depends for its usefulness on a series of reactions between the compounds of which it is composed and water. Most important of those reactions is the hydration of the calcium silicates to form a colloidal gel of calcium silicate hydrate that solidifies to a hard mass. This material forms a continuous phase that surrounds and encloses each piece of aggregate in a concrete grout, and bonds the whole into a rocklike structure. The behavior of the material will be determined by many factors, such as composition of the cement, fineness of the cement, the water-cement ratio of the paste, the grading and nature of the aggregate, and the time, temperature, and manner of curing. Also, as previously stated, the presence of entrained air in the paste will greatly affect the durability of the structure in some exposures. Extensive research is under way in many countries on the problems bearing upon the reactions of the cement compounds with water and the character of the hydration products. The methods of study include X-ray powder diffraction, crystal structure, electron microscopy and diffraction, phase equilibria, differential thermal analysis, spectroscopy, heats of reaction and others. By these means information is accumulating on the chemical nature of the several hydration products, the arrangement of the atoms in the crystals, and the morphology of the gel hydrates. Knowledge of the composition and structure of the materials

leads to an understanding of why they behave as they do and hence to a control of their properties. It is by means of basic research of this character that the cement industry has advanced to supply the construction demands of a rapidly growing society. For further information on the design, fabrication, curing, and durability of concrete structures, see CONCRETE.

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ROBERT HERMAN BOGUE,
Director, Portland Cement Association Fellowship,
National Bureau of Standards.

CEMENTATION PROCESS. See ARMOR PLATE; IRON.—*Iron and Steel Industry in the United States*; STEEL, MANUFACTURE OF CRUCIBLE.

CEMETERIES. See BURYING PLACES; NATIONAL CEMETERIES.

CENABUM is an ancient name for Orleans, France (q.v.).

CENCI, chèn/chè, Beatrice, Italian noblewoman, tragic figure of the late Renaissance: b. Rome, Feb. 6, 1577; d. there, Sept. 11, 1599. One of the 12 children of Francesco Cenci (1549-1598) by his first wife, she was born in the Palazzo Cenci, Rome. Francesco, a man of violent temper and debauched life, hated and feared by his family, in 1595 imprisoned his second wife Lucrezia with Beatrice in a lonely castle of the Colonna family called La Petrella, on the road to Naples. During occasional visits to La Petrella he mistreated the women. Apparently he was unaware that Beatrice and Olimpio Calvetti, the castellan, had fallen in love; however he had Olimpio discharged from his command. Finally Beatrice, her brothers Giacomo and Bernardo, and their stepmother plotted the death of the unnatural father. Olimpio and a hired assassin murdered Francesco in his bed on Sept. 9, 1598. Early the next year the entire Cenci family was arrested. Lucrezia and the two sons confessed,

as did Beatrice, finally, under torture. Pope Clement VIII refusing a pardon, the women were publicly beheaded, Giacomo was put to death after long torture, Bernardo alone being spared on account of his youth, and released after a year's imprisonment. The family estates were confiscated.

A portrait by Guido Reni in the Palazzo Barberini, Rome, is said to represent Beatrice. Shelley's tragedy, *The Cenci* (q.v.), is based on a version of the episode, which has been the theme of many novels, notably F. D. Guerrazzi's *Beatrice Cenci* (Milan 1872). The best historical account is that by Corrado Ricci, *Beatrice Cenci* (Milan 1923; Eng. tr. London and New York 1925).

CENCI, The. Shelley's poetic tragedy *The Cenci* was his one attempt to write "for the multitude" and for the stage. Though following the model of Elizabethan tragedy, and containing echoes from Shakespeare—mainly from *King Lear*, *Macbeth*, and *Othello*—it is yet a work of individual genius. While it may be uncritical to assert that *The Cenci* is "the greatest English tragedy since Shakespeare," it is the writer's opinion that no tragic poet since John Webster (1580?-1625) had equalled this play in somber power.

The plot is founded on an old manuscript account of the crime, trial, and execution of Beatrice, a daughter of the great Roman family of the Cenci, at the close of the 16th century. This particular account, one of many such that appeared within the century following the event, is utterly misleading in its picture of Cenci as an unnatural monster and of his daughter as an angel of light; but Shelley accepted it as authentic, and followed it closely, except that he added the banquet scene in the first act. His interest was increased by the supposed portrait of Beatrice, reputedly by Guido Reni.

The play was published in London in 1819. Though received with comparative favor by the public, it was criticized on account of the nature of its subject. Shelley, who was an almost infallible critic of his own poetry, said, "It is a work of art; not colored by my feelings nor obscured by my metaphysics." And, indeed, *The Cenci*, intrinsically great, is no less than astonishing as the production of the poet of *Prometheus Unbound*. Except for the evidence of this play, no one could have credited Shelley with so much knowledge of human character and such power to represent it.

Owing to the difficulty of presenting the incidents of the story on the stage, the action of *The Cenci* is weak. The fifth act, however, is not only perhaps the finest thing that Shelley ever wrote, but certainly compares favorably in all essentials of tragedy with anything outside of Shakespeare. The characterization is on the whole firm and convincing; though Orsino, whose crafty wickedness is contrasted with the utter insolence of Cenci, seems hardly consistent. The vacillating Giacomo and the irresolute Lucrezia throw into high relief the unwavering will of Beatrice, who grows in nobility until at the close she fills the action with the splendor of her purity and strength, a tragic heroine claiming kinship with the greatest of her kind—with Antigone, Electra, Juliet, Constance, and Webster's Duchess of Malfi. The diction is simple and concrete; the style, highly dramatic and appropriate. Except for the description of the chasm

in the third act, not a passage, scarcely even a line, but contributes directly to the action or characterization. The effect of the play is that of unrelieved gloom. As George E. Woodberry puts it, "In it culminates that fascination of horror in Shelley which was as characteristic as his worship of beauty and love, though it is less omnipresent in his poetry."

MARION TUCKER.

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CENERENTOLA, La, opera in two acts, based on the story of Cinderella, with music by Gioacchino Rossini and a libretto by Jacopo Ferretti. Among Rossini's operatic works, *La Cenerentola* is generally placed just below *Il Barbiere di Siviglia*, though it has not held so enduring a position on the opera stage.

Poorly received in Rome at the time of its first performance on Jan. 25, 1817—barely one month after Rossini and Ferretti had begun their collaboration on the work—*La Cenerentola* won great popularity by the end of the opera season that year. This was largely because the main role's great difficulties were an irresistible challenge to the singers of the time. However, the decline of the *bel canto* tradition, particularly in the mezzo range in which the title role is written, resulted in the gradual disappearance of *La Cenerentola* from the repertoires of opera companies. There are no records of professional performances between 1860 and 1934.

In the latter year the opera was revived with the Spanish mezzo, Conchita Supervia, singing the lead at a performance in London, and the New York City Opera Company produced the work on March 26, 1953, with notable success.

CENIS, Mont, mōns-nē' (Ital. *MONTE CENISIO*, mōn-tā chā-nē'zyō), a peak of the Graian Alps between Savoy in France and Piedmont in Italy, on the frontier between the two countries. It is composed mainly of strata of schist, limestone, and gypsum uplifted to an elevation of 11,755 feet. It forms the natural watershed between the Arie, a branch of the Rhone River, and the Dora Riparia, a tributary of the Po River. The flanks of the mountain are rather heavily forested.

It is famous for the nearby Mount Cenis Pass, 6,765 feet above the sea, used from ancient times down to the present as one of the gateways from the north into Italy. So favorable was its location that it was chosen by Napoleon I as the site of a fine highway built by his order during the years 1803-1810. With the development of railways, however, this highway proved quite inadequate as an artery of commerce and the present tunnel became a major project.

The spot chosen underlay the Col de Fréjus, about 15 miles southwest of the main peak, and here King Victor Emmanuel II exploded the first mine in a ceremony marking the start of construction in August 1857. As the entrance on the French side lies at an altitude of 3,801 feet, while that on the Italian side is 4,246 feet, laborious calculations involving both elevation and direction were necessary, consuming more than a year. So accurately were they conducted, however, that when work crews, operating from both ends of the tunnel, met on Christmas Day 1870, the floor and walls coincided exactly.

The length of the tunnel is 42,145 feet, or nearly eight miles, from Modane, France, to a point near Bardonnecchia, Italy. The height is a minimum of 24 feet, 7 inches, while the width, varying from 25 to 26 feet, accommodates a double track. Both walls and roof are lined with masonry more than two feet thick, and the floor, where necessary, is strengthened with arches. To facilitate drainage, the tunnel slopes 128 feet to the south and 473 feet to the north from its mid-elevation. About one eighth of the construction was completed by hand labor. Boring machines were then introduced. Nearly a hundred borings and more than a hundred pounds of gunpowder were required for each average yard of advance through the solid rock. The cost of the enterprise, 75 million francs, or some \$14,475,000, was shared by the French and Italian governments and by the Northern Railway Company of Italy. The tunnel was formally opened on Sept. 17, 1871, and remains a conspicuous monument to engineering skill.

CENOBITES, sĕn'ô-bīts (Gr. *koinos*, common + *bios*, life), religious men or women living in community for the practice of asceticism. Asceticism, not peculiar to any one creed or confession, represents an attempt of the soul to achieve union with God. Cenobites seek to attain this end rather by social than by individual means. Though known in paganism and Judaism also, cenobites have flourished chiefly among Christians. Their system developed into monasticism which played a prominent role in medieval church history. The greater number of religious ascetics in the modern Christian church are cenobites, although some exemplars of the eremitical (hermit) or semi-eremitical life remain.

CENOGENESIS, sĕ-nô-jĕn'ĕ-sīs. Among many of the animals which during post-embryonic growth pass through a series of stages similar to the ancestral forms of their types—a process known as palingenesis—there are certain species in which the different stages of growth or metamorphosis are crowded back to the embryo stage, or abbreviated, and the animals hatch or are born in the shape of their parents. This is cenogenesis.

Certain frogs, like the tree toad of Guadeloupe, W. I., where there are no marshes, do not pass through a tadpole stage, but hatch without tails, and with legs, and otherwise resemble their parents. The same is the case with certain shrimps and crabs, and is partly the case with the lobster. In all such instances the direct development is apparently due to a difference in the environment or other conditions of life, as for example, in certain crustacea, to a change from salt to fresh water.

CENOTAPH, sĕn'ô-táf (Gr. *kenos*, empty + *taphos*, burial), a monument erected in honor of a deceased person who is buried elsewhere or whose body cannot be recovered. Cenotaphs were often erected by the ancients, who believed that when the body was not buried the soul could not be admitted into the abodes of the blessed. The term is also applied today to monuments erected in memory of the men who have fallen in war.

CENOZOIC ERA, sĕ-nô-zō'ĭk, the last great division of geologic time, beginning about 60 or 70 million years ago. The name, meaning "recent life," was coined by John Phillips in 1840

and was spelled "Kainozoic," a form still widely used. The era is divided into the Tertiary and Quaternary periods, with the Paleocene, Eocene, Oligocene, Miocene, and Pliocene epochs assigned to the former, and the Pleistocene to the latter. (See separate articles on each of these periods and epochs.)

Life in the earliest Cenozoic differed from that of the latest Mesozoic just preceding in various degrees. There were small changes such as are invariably present in the geologic succession, in which kinds of close relatives modify from ancestor to descendant. Such differences may be sufficient to permit separation of the earlier Cretaceous period from the Paleocene, but may be no greater than those reflecting differences of climate rather than time. Abrupt changes in which characteristic forms vanish completely without leaving lineal descendants are more definitive. Such changes are exemplified by the ammonoid cephalopods. Though some of them may have survived the Mesozoic, and some rocks of the Paleocene may mistakenly be called Cretaceous because of their presence, they never attained the abundance they enjoyed throughout the Mesozoic. And the dinosaurs, great reptiles on Mesozoic lands, have never been found in Paleocene in America and only doubtfully in Europe.

The average life in the Cenozoic soon became quite unlike that of the preceding era. In the seas the differences at first were negative ones, such as the absence of ammonites. Disc-shaped one-celled animals, orbitoid foraminifera like the nummulites that fill the limestone of the pyramids, grew in the warmer seas; a few of these had lived in the Cretaceous. But these contrasts would not strike the average observer.

On the lands, the forests of the Paleocene had many of the deciduous trees that dominate present forests of similar climates—poplars, oaks, maples, birches, and their associates. The conifer *Sequoia*, of limited present range in North America, spread over larger regions. And there were grasses and herbivorous plants on the plains such as had appeared before and still abound.

It was in the vertebrate inhabitants of the forests and plains that Cenozoic life introduced the greatest changes. The mammals had existed during the Mesozoic as obscure little animals, insignificant in numbers and size in comparison with the great dinosaurs and other reptiles. Some kinds of reptiles lived on, such as turtles, snakes, and crocodiles, but the greatest died. Soon the mammals developed into many varieties, some to become immense and grotesque, and vanish. Amblypods, huge, clumsy hoofed beasts somewhat resembling the hippopotamus, but only distantly related, did not survive the Eocene. Titanotheres, elephantlike creatures having long nasal projections resembling tusks, roamed Oligocene plains and are preserved in the clays of the Dakota Badlands, their last resort. Mammals ancestral to the elephants were small and undistinguished in the Miocene, migrants from Asia where they had been since Eocene; their tusks and trunks lengthened as their size increased. Similarly a little doglike animal in time grew larger, acquiring a longer head and legs and high-crowned teeth, and losing toes until it was the fleet one-toed horse. The record of man is not as well authenticated; perhaps his ancestors were tree-dwellers whose skeletons were not as frequently buried. Some primates have been found in Tertiary rocks in scattered regions, but the first resembling

modern man is from the Pliocene or early Pleistocene, a small fraction of the time since the beginning of the Cenozoic.

MARSHALL KAY,
Department of Geology, Columbia University.

CENSER, sĕn'sĕr, a vessel in which incense is burned. Censers were employed by the Jewish priests for presenting incense to the Lord in the sanctuary. Flavius Josephus tells us that King Solomon made 20,000 gold censers for the temple of Jerusalem to offer perfumes in, and 50,000 others to carry fire in. Censers, or thuribles, are used in some modern churches, especially in the Roman Catholic Church at mass, vespers, and on other occasions. They are suspended from chains, by which they are swung about in the hand to spread the incense in all directions. They are usually made of brass or copper, sometimes of silver or gold. Of their precise shape before the 12th century there is little record. The earliest ones are richly decorated, set with jewels and sometimes made in the form of small churches. They were also often made in two hollow halves and shaped like a ball. The upper half varies very much in form. The lower half holds the charcoal and the incense, while the upper half is perforated with holes to allow the smoke to escape.

CENSORS (Lat. *censores*), high officials in ancient Rome during the republican period. Unlike other magistrates two censors were elected for 18 months (not for a year), once in five years. Among their official duties the most important were: registration of citizens, their families, and property for military and taxation purposes for a five-year period (*lustrum*), and control of public morals (*regimen morum*). As censors of morals they had authority to brand citizens with a *nota censoria* for bad treatment of wives, children, or slaves, luxurious living, misdemeanor in office, embezzlement in guardianship or partnership, and other offenses. The censorial blame produced manifold disadvantages to, and disqualifications of, the persons censured. Of great political importance was the privilege accorded the censors of keeping and revising periodically the lists of senators (*lectio senatus*) which became their exclusive right in the late 4th century B.C. They not only confirmed the actual membership of the senate but might also select new senators among the best (*optimi*) citizens and exclude others by a *nota censoria* for bad conduct. The vacancies thus created were filled by the censors' appointment of new members. In the field of financial administration, the censors concluded agreements concerning sales and leases of state property (public land, mines, quarries) with private individuals, and agreements concerning the collection of taxes and customs duties with tax-farmers (*publicani*). Construction of public buildings, roads and bridges was also under their supervision. During the final three and a half years of a *lustrum*, when the censorship was vacant, the censors' duties were accomplished by other high magistrates (consuls, praetors). Originally censorship was a patrician magistracy, but as early as 356 B.C. a plebeian censor was elected. In the early Principate censors appear only sporadically and with very limited functions.

(Philadelphia

A. BERGER.

CENSORSHIP. In a strict sense censorship is the term applied to the operations of a person or a board or committee of persons authorized to intervene between a producer of publishable material and the consumers to whom he offers that material, and to prohibit either the producer from publishing, or the consumer from reading, hearing, or otherwise acquiring knowledge of whatever part of such material the censor deems unsuitable. The censor may be authorized by a sovereign government (or by virtue of powers delegated by that government to a lesser government, such as a municipality), or by a nongovernmental organization such as a church or secular society, possessing large power to command the obedience of its members or followers. Censorship of this kind operates before the material is communicated to the consumer, and is therefore described as *preventive censorship*. It requires a censor or body of censors invested with large discretionary powers and not merely interpreting, as a court does, the language of a general statute.

In a looser sense the term has come to be applied to the whole process of the enactment and subsequent enforcement of laws limiting the freedom to publish, except in so far as they are concerned with the protection of the rights of others, as in the case of libel, slander, breach of copyright, or incitement to violence. In this sense censorship involves no censor, for judgment as to publishability is made by a jury or judge, enforced by punishment, subject to appeal, and limited by a reasonable interpretation of the language of a general statute. This is termed *punitive censorship*. But the language of the law may be so broad, and the latitude of interpretation so great, as to leave little difference in effect between this method and the employment of a censor with unfettered discretion. Punitive censorship is of course an exercise of the sovereign power of the state.

Censorship may be, and has been, applied to any and all means of communication, from human speech to modern developments like television, and including all the arts. (Even music appears to be censored in Russia.) The term publication means the act of communicating or offering to communicate by any of these means, usually to the public in general. Communication to a single recipient, as by letter or private conversation, is not ordinarily regarded as publication, though in wartime, when the reasons for censorship are different, it may become censorable. The private censorships cannot prevent publication of disapproved material, but they can call upon those persons who accept their judgment—the members of the religious body or the supporters of the society—to refuse to consume it. This operation is really more in the nature of a boycott than of a censorship, but the prospect of such a boycott frequently has the effect of dissuading the publisher from publishing or his distributing agent (bookseller or moving picture exhibitor) from offering the work in certain territories. Such private censorship may thus have an important influence in limiting the selection of material offered to the public, especially in the mass media where production is very costly and the largest possible audience is required. It is probably less restrictive in the case of books, especially those of a serious nature. A kind of private censorship is exercised also by libraries, art galleries, and similar institutions, when they exclude from circulation or exhibition certain works on the ground,

not that the public would not want to read or see them, but that such work would not be good for the public.

Indirect Censorship.—Public authorities often exercise censorship by the use of powers originally granted for quite different purposes. The state's control of imports, and of certain means of communication such as the post office, is commonly used for purposes of censorship, sometimes without any appeal to the courts. In the United States this method is limited by the guarantee of free speech (which has been interpreted as extending to free communication by a great variety of means) in the Bill of Rights, but most other countries have no such limitation. The United States Tariff Act prohibits importation of "obscene" matter, but an amendment of 1930 assigned the determination of obscenity to the courts, and in 1931 James Joyce's *Ulysses*, previously banned, was declared admissible. The Secretary of the Treasury may moreover admit "the so-called classics or books of recognized and established literary merit" even though obscene, but may in his discretion confine their importation to non-commercial purposes. In Canada the Customs Department maintains a prohibited list containing many books which have never been submitted to court judgment, and which if manufactured in Canada would have to be condemned by the courts before they could be suppressed; William Faulkner's *Sanctuary* is an example.

The police power to license halls and public meetings and the distribution of pamphlets in public places has often been used to prevent the holding of meetings and the distribution of literature by strikers or by an unpopular religious or political sect. The United States Post Office forbids the transmission by mail of many classes of matter not otherwise unlawful. The municipal licensing of theaters has been widely used to control the entertainment provided in them. If the authorities desire to disclaim any interest in the nature of the show, they can always find some grounds in the fire regulations on which to close or threaten to close the theater. In Boston there is a frank censorship by a board consisting of the police commissioner, two captains and a clerk, but since 1938 the regulations have required at least one public performance and a hearing before the license can be cancelled. Eugene O'Neill's *Strange Interlude* and many other classics of the American theater have been kept off the stage in Boston. In 1931 the New York City Commissioner of Licenses threatened newsstands with cancellation of their licenses if they were found guilty of selling lewd and obscene literature.

New Modes of Communication.—Prior to 1900 the available modes of public communication were practically confined to the spoken word, the theatrical performance, the printed book, the periodical, and the public exhibition of works of art. Both the theater and the printing press were traditionally subject to censorship by license in almost all countries until the rise of liberal opinion in the 18th century, and the licensing of plays by the lord chamberlain continues a sole relic of that system in Great Britain, where the licensing act for the press expired in 1695 and some surviving powers of the government over newspapers were declared illegal in 1765. The present policy both in Great Britain (except in the theater) and in the United States is based on the assumption that anything may be published

which does not infringe the rights of other persons, offend public morals, or promote sedition.

All of these older methods of communication have the common characteristic that anybody who can pay for it, can have the use of a theater, a hall, or a printing press. The process of communication by radio, discovered and developed after 1900, lacks this characteristic. The number of wave lengths or channels available in any given area is limited, and the effective use of any one of them requires that the user be protected against any other broadcasting on the same channel in the same area—a protection which can be provided only by the authority of the state and often requires treaty action by several nations. The licensing of radio and television stations is therefore indispensable. The number of stations being limited, the principle of free speech will not operate automatically; a man who cannot obtain access to any existing station cannot go out and get himself a new station, as he could a printing press. The state has therefore had to concern itself with the problem of securing a reasonable freedom of access to radio and television for all kinds of different ideas and opinions. Great Britain has sought to do this by means of the operation and control of the whole radio system by a government monopoly, the British Broadcasting Corporation, and nothing can be broadcast except by that body. Canada has set up the Canadian Broadcasting Corporation owning and operating a number of important stations and possessing large powers of control over the remaining stations in private hands. In both countries there is therefore a very direct control over what is broadcast, but in practice the private stations in Canada are very little interfered with except by general regulations, and there is no precensorship of broadcast material. (It would have little effect in any case, since almost all Canadian listeners can reach United States stations.)

In the United States the Federal Communications Commission, established by an act of 1934, was given power to license stations for limited periods and to refuse renewal in case of certain types of misbehavior, but was specifically forbidden to exercise censorship. The act does not however forbid the commission to evaluate the total performance of a station in considering renewal. The Commission on Freedom of the Press organized by the University of Chicago in 1944–1945 recommended that the constitutional guarantee of freedom of speech should be extended to cover radio and motion pictures; in 1953 the Supreme Court adopted this view concerning the latter, but the limitation of wave lengths makes its application very difficult in radio and television. How can a man have a right to say something over the air, unless there is some particular radio station upon which he can enforce that right, and, if he has that right, what becomes of the freedom of the radio station?

The financial structure of the radio and television industry, wholly dependent on revenue from advertisers if in private hands, and on revenue from taxes if in public hands, is a strong guarantee against misbehavior of the kind which, if indulged in to any extent, would call for censorship. Radio and television are unique in this second respect, that they alone among means of communication are never paid for by the consumer. The product is delivered free of charge into the consumer's home, and the producer's tendency is to avoid anything which would give the slightest offense to any

class of listener. Broadcasting's great weakness is not that it needs censorship, but that it never does anything which would make anybody want to censor it. The complaint of liberals in the United States about it is that, like the motion picture industry, it over-censors itself, in an effort to avoid anything disturbing to listener or viewer.

The motion picture in the United States is also accused of over-censoring itself, but for an entirely different reason. Internal censorship in the movies is an effort to avoid the economic consequences of an excessive and varying censorship by public authorities in many different localities. The motion picture in its infancy was not treated as a serious art form. It is not therefore surprising that in 1915 the United States Supreme Court did not consider it entitled to the constitutional guarantees of free speech, and thus opened the door to censorship by individual states or municipalities. (The later reversal of this decision appears to deprive the censors of their power to prohibit absolutely the exhibition of disapproved films or sections of films in their jurisdiction, but such exhibition can be made difficult by other means.) The provinces of Canada exercise the same right of censorship, and there is no Bill of Rights to hamper them. In Great Britain there is only the general decency law as enforced by the courts.

The early and widespread development of movie censorship was partly due to the fact that in this industry the act of publication takes place in two stages, first the performing and recording, and second the exhibition of the resultant film. These two stages may take place in different jurisdictions with radically different attitudes on public morals. Each jurisdiction seeks to protect its own moral code by setting up and enforcing its own standards. The film when once manufactured is incapable of being altered except by cutting, a process which may be very detrimental to its entertainment value. American film producers therefore try to mitigate the effects of local censorships by imposing upon themselves a voluntary censorship of a third type not yet mentioned in this article, namely *industrial censorship* or censorship by an organization of producers of the censored material. The Breen Office administers the Breen Code, and withholds its seal of approval from all films which it considers to fall short of full compliance. It cannot prohibit the exhibition of unapproved films, but exhibitors who make a practice of showing them may find their supply of films from the major producers cut down. Another instrument of film censorship, belonging to the type which works upon the consumer, is the Legion of Decency, formed by the Roman Catholic Church and the National Federation of Churches, which by blacklisting can cut down attendance and even, where it is sufficiently strong, induce exhibitors not to show a film.

Reason for Censorship.—The reason for censorship in general (other than wartime censorship, which is an entirely separate matter) is the desire to protect the public or a certain section of it from the evils which are supposed to flow from the communication of disapproved ideas or concepts, and the reason for preventive censorship in particular is that these ideas or concepts are considered too dangerous to be allowed currency even during the time necessary for their examination by the courts. In the 19th century the grounds for disapproval were usually related to public morals, although in British countries and

in Europe there was also a tendency to object to extreme or revolutionary criticism of the nation's political institutions. The United States with its revolutionary tradition put less accent on this aspect. But since the development of the ideological "cold war" between the Communist totalitarian states and the liberal democracies, all the latter, in varying degrees, have become apprehensive about the spread of subversive theories. The political concepts of these two groups of nations are based upon incompatible doctrines of the relations between men and society, and conversion to a new doctrine involves disloyalty to the political institutions of the older one. Even a democratic society now feels called upon to adopt strong measures to prevent the spread of anti-democratic ideas in its territory, not so much from the fear that these ideas will win the support of a majority as from the fear that their holders may acquire control of the machinery of government by conspiracy and force, as has happened in several once democratic countries. This is a real danger, but so also is the danger that by a too rigid suppression of all that is suspected of totalitarian tendencies one may suppress that free play of criticism, that tolerance of new and at first unpopular ideas, which are essential to the permanent functioning of democracy. Thus the Chicago Commission on Freedom of the Press recommended that the laws against utterances favoring revolutionary change should be amended so as not to apply "where there is no clear and present danger of violence resulting." As they stand, such laws can be interpreted as banning the works of Karl Marx and Georges Sorel as rigidly as they would ban a contemporary pamphlet calling on American citizens to rise and massacre shareholders of a large corporation.

The censoring of material from the point of view of sex morals, it has been pointed out by social scientists, coincides closely with the rise to political predominance of the middle classes. A dominant aristocracy seldom concerns itself much about that subject. One reason may be that the position of the middle class can be maintained from generation to generation only by those qualities of thrift, prudence, and self-control which are most threatened by sexual laxity. Andrew Lang pointed out long ago that "English literature had been at least as free-spoken as any other to the death of Smollett (1771). Then, in twenty years at most, English literature became the most 'pudibond', the most respectful of the young person's blush, that the world has ever known." The change was duly but slowly registered in law and court decisions. A Society for the Suppression of Vice was formed in 1802. (Its American counterpart, under Anthony Comstock, did not come until 1873.) In 1857 Lord Campbell's Act replaced the old common law on indecency, and in 1878 a decision of Lord Chief Justice Cockburn (still followed) defined obscenity as the tendency "to deprave and corrupt those whose minds are open to such immoral influences and into whose hands a publication of this sort may fall." This has compelled the courts in all British countries to consider the effect of the work, not on the ordinary reader, the *homme moyen sensuel* of French jurisprudence, but on those, perhaps relatively few, whose minds are open to evil influences. Under the influence of this decision a great number of works of fiction have been condemned in Great Britain and their publishers subjected to severe loss, heavy fines and often imprisonment, and scientific works have been

either condemned or permitted only for sale to qualified persons. Until about a generation ago the United States courts followed the same tendency, but they have now shaken themselves free from it, and also from the practice of considering the effect of isolated passages rather than that of the work as a whole. Thomas Hardy's *Tess of the d'Urbervilles* (1891) had to be expurgated for American publication, but today the American publisher enjoys much more freedom, especially in the matter of language, than his British counterpart, and several British authors, Richard Aldington among them, publish in the United States first and submit to expurgation in Great Britain later.

A further reason for the spread of censorship in the sphere of sex morals in the last half-century has been the immense increase in the freedom of action of the adolescent age-group and in their command of money. Before 1900 the dime novel was almost the only form of entertainment on which the adolescent spent his own money. If he bought a more costly book or went to a theater it would be with his parents' consent and money. Today in English-speaking countries the juvenile goes to the movies, perhaps several times a week, with his own money and alone, and buys his own magazines and paper-covered novels. The family having surrendered its guardianship of these youngsters, there is room for the contention that the state must take over. Unfortunately it has nowhere been found possible to apply the restrictions to juveniles alone, and the effort to protect their morals often leads to suppression of serious works which should be available to adults. After World War II the tremendous growth in the field of comic book publishing was accompanied by increasing public concern over the content and quality of some of these books. Various groups demanded either imposition of regulatory codes on comic book publishers or voluntary adoption of certain rules and standards by the publishers. United States Congressional committees held hearings in an effort to determine whether legislation was needed to regulate comics publishing. In Canada the House of Commons passed a bill in 1949 which outlawed crime comics, but in the same year Gov. Thomas E. Dewey of New York vetoed as unconstitutional a bill which required that publishers of comics be licensed.

One other area of censorship about which there has been a great reversal of opinion in the last forty years is birth control. Advocacy of and instruction in birth control was almost universally banned until near the turn of the century, but today in all but predominantly Catholic countries it is almost universally tolerated, except in such restricted fields as radio and motion pictures. The objection to it is no longer based on obscenity but on purely ethical or religious grounds. Thus in Ireland, under the Censorship of Publications Act of 1929, the Minister of Justice has an advisory board which reports to him when it finds that any publication is indecent or obscene or advocates the prevention of conception, or when any periodical devotes "an unduly large amount of space to the publication of matter relating to crime." The minister may then make a prohibition order. Obscenity is given a very wide interpretation in Ireland, and there is a long list of books, many of them highly regarded elsewhere and many of them by Irish authors, which are banned from Ireland by such orders. Indirect censorship

against birth control information, by exclusion from the mails, began in the United States with the Comstock Law in 1873.

Wartime Censorship.—Censorship of the press in time of war rests upon entirely different grounds and is of an entirely different character from ordinary censorship in liberal countries. It has two main objects, both peculiar to the state of war: (1) to prevent the enemy from acquiring knowledge of military value, and (2) to prevent the circulation of matter calculated to weaken the national morale in the home country. The first object is generally regarded as having an absolute priority; nothing should be published which could convey information of importance to the enemy. The second may conflict with another object which also has large claims, namely the requirement that the public should have enough knowledge of the current situation to enable it to criticize and improve the conduct of the administration. The change of government which brought about a great improvement in the munitions supply of Great Britain in World War I could not have been effected without first breaking down some of the censorship restrictions.

Even in time of peace it may be desirable for a nation to keep certain kinds of knowledge from potential enemies. In totalitarian countries this is effected by censorship, but in liberal countries there is a reluctance to employ this kind of censorship in normal times, and the purpose is attained by restricting the knowledge of such matters to persons who can be relied on to maintain secrecy. The total amount of such knowledge is now extremely large, including large areas of science as well as purely military matters, and hence arises the "security" problem which has so plagued democratic countries since World War II. In 1951 President Harry S. Truman issued an executive order requiring all civilian agencies of the United States government to tighten control over releases of information which might affect national security. Only the State and Defense departments and the Atomic Energy Commission had previously been subject to such rules. The order of the president was widely criticized as censorship. President Dwight D. Eisenhower issued an executive order in 1953 defining the categories of classified material set up in the earlier order and also removing from many agencies the authority to classify information.

Wartime censorship is concerned to prevent the communication of knowledge, not merely to the public at large, but to a single unauthorized person. It has therefore to prevent not merely publication, but also person-to-person communication, of matter which it is desired to keep from the enemy. It thus involves scrutiny of private correspondence, especially such as crosses national borders. In this operation it pursues also a third object, namely the procuring of information useful to the administration, and so becomes an investigatory agency.

Governments with constitutionally limited powers frequently have difficulty in overcoming these limitations to meet their wartime needs. The United States Constitution contains little provision for enlarging the powers of the central government in time of war; even the suspension of habeas corpus is authorized only for rebellion or invasion, not for war at a distance. Canada has a similar situation, though in the absence of a Bill of Rights for the individual there are only the rights of the provinces to be considered; but

Canada has overcome the difficulty by the invention of the doctrine of emergency powers (nowhere mentioned in the constitution) which enables the national government to do practically anything by declaring a state of emergency. (The courts have upheld an order-in-council compelling native-born Canadian citizens, of Japanese ancestry, to submit to deportation to Japan, but it was never put into effect.) In Great Britain the powers of Parliament are unlimited.

In the United States it is doubtful whether some of the convictions in World War I under the Sedition and Espionage Acts were strictly constitutional under the Bill of Rights. In World War II these acts were more strictly construed, and a decision of the Supreme Court in *Hartzell versus United States* (1944) showed a due concern for the maintenance of civil liberties. To some extent this improvement may have been due to a greater unanimity of opinion in favor of the war than existed in the earlier conflict. In the absence of safe constitutional ground for proceeding against periodicals by direct action the government in World War I fell back largely on the power to exclude from the mails. This was conferred on the postmaster general, with no court appeal allowed, in the case of any person making false statements about the armed forces, encouraging disloyalty, or in other ways interfering with the prosecution of the war. Exclusion from the mails is an instrument which can be used for the total suppression of a periodical with a widespread circulation, and more than 100 periodicals were thus excluded in 1917-1918. In World War II the use of this device was much more moderate, but *Social Justice*, the organ of the Rev. Charles Coughlin, was deprived of second-class mailing privileges along with a few other papers. In both these wars the actual direct censorship of the press in the United States, in the sense of excluding matter which the government desired not to be printed, was "voluntary," effected by the free cooperation of the newspapers themselves, but behind the persuasive force of the Censorship Board under George Creel (1917) and the Office of Censorship under Byron Price (1941) was always the power to exclude from the mails. An interesting example of cooperation was the withdrawal of certain "public participation programs" from radio because of the risk that messages might be sent to the enemy by code.

In Great Britain, situated within the theater of active hostilities, the government made a much more direct use of its unlimited powers. Nothing could be printed within the country or sent out of the country by any means without being passed by an official censor; an immense staff was employed for this purpose, and it was said that at one time during World War II the only leakages of military information were those which occurred through inadvertent mention of the location of individual members of the armed forces in local parish magazines which no censor could possibly find time to examine.

At the start of the Korean War in June 1950, the only censorship of correspondents covering news at the front was a voluntary one. The individual reporter was trusted to decide what should be included in or omitted from his dispatch. The members of the press, however, experienced difficulties in applying proper security standards, and it soon appeared that different correspondents had imposed on themselves unequal restraints. The result was that

some reporters filed exclusive stories dealing with matters which other reporters had hesitated to use on security grounds. In December 1950 the order was changed to impose a full military censorship after many complaints from the correspondents and because of certain instances of abuse, in one case the news of a general's death having been published before his widow had received official notification.

In the totalitarian countries, since the individual citizen is not supposed to have any right either to free expression or to the receipt of information other than what the government thinks fit to allow him, censorship presents no difficulties, and in Japan, accustomed for generations to a high degree of discipline, the concept of "thought control" in the national interest was openly adopted as government policy until the surrender of 1945. In Russia the periodical press is practically an agency of the government. A correspondent of Tass, the Russian news bureau, was for that reason expelled from the parliamentary press gallery at Ottawa in 1950, but his successor, with somewhat different credentials, was granted admission.

Censorship in History.—Governments have at all times sought to restrain the spread of ideas considered likely to undermine their authority. That authority was usually associated also with the predominance of a certain religious belief, and criticism of that belief was commonly repressed. In Athens in 399 B.C., Socrates was sentenced to death for impiety and corruption of youth. The Roman Empire from Augustus to Constantine was tolerant of all kinds of religious observances but required everybody to sacrifice to the divinity of the emperor on pain of death, and suppressed many writings as dangerous to the imperial authority. Throughout the medieval period the Roman Catholic Church prohibited the circulation of heretical works, but it was not until the invention of printing that the procedure for dealing with them became systematic. The rapid multiplication and wide circulation of printed books became embarrassing to both the religious and the secular authorities, and in 1501 a papal bull established the principle of licensing for all printing. In 1564 there was issued with papal approval a report of a committee of the Council of Trent bearing the title *Index Librorum Prohibitorum*, which still continues to designate the list of books which Catholics are prohibited to read except under very special circumstances. The periodical revision of this list is now in the hands of the Congregation of the Index, a body composed of several cardinals with numerous consultants and examiners. In the enforcement of these prohibitions the church was at first usually supported by the secular authorities, but since the Reformation the increasing separation of church and state, and the monopoly of legislative power by the latter, have in most countries reduced the prohibitions to a moral rather than a legal obligation, and left printers free to issue their products without any reference to ecclesiastical authority.

In England the Reformation at first merely transferred the power of licensing from the Catholic Church to the monarch, who became the head of the Church of England. Elizabeth I confined the right of printing to London, Oxford, and Cambridge, and authorized the Messengers of the Press to enter houses in search of uncensored presses and publications. The Long Par-

liament followed the same policy, and Milton's *Areopagitica*, the classic work on freedom of publication, was a reaction to a parliamentary ordinance of 1643. The licensing policy thereafter met with growing resistance, and for several short periods the Licensing Act failed to be renewed, but it was not finally abandoned until 1695, a date which marks the definite establishment of the principle of freedom of the press in England. The monopoly license to print was then the only existing form of copyright, and a period of widespread piratical printing followed until the first copyright act in 1709. Developments in Scotland followed the same course up to the time of the Union, but the penalties were even more severe, and in 1585 a libelous writing against the king was punishable with death. The power to license works treating of religion was granted to the General Assembly of the Kirk.

France, although it remained Catholic, saw the same process of transfer of the licensing power to the secular authority. An ordinance of 1566 vested in the crown the licensing of theological works previously held by the University of Paris. It was in his capacity of Minister of the Crown that Cardinal Richelieu in 1629 made it a capital offence to publish a work against religion or the state. In France the Revolution abolished all restraints on publication, but this speedily proved unworkable, and throughout the 19th century the successive changes of constitution were accompanied by corresponding changes in the form and degree of press control. During World War I France had an example of what is perhaps the most futile of all forms of censorship in a liberal country—the entire suppression of a powerful newspaper—when Clemenceau's *L'Homme Libre* was stopped, only to be immediately followed by *L'Homme Enchaîné*.

In Canada there was no printing press until the end of the French regime. In the British colonies of North America which later became the United States the governors exercised the licensing power, but only against increasing opposition from hostile public opinion, and by the time of the American Revolution the idea of a free press was already firmly established in all parts of the new republic. As Canada remained under British control it developed there more slowly, but by 1826 the government in Upper Canada was already finding it difficult to enforce control of the press by action through the courts. In an effort to silence William Lyon Mackenzie, the leading Opposition journalist, the ruling faction in that year resorted to a mob attack on the premises of his *Colonial Advocate*, for which he succeeded in recovering substantial damages. The governing party then adopted the method of repeatedly expelling him from the Legislative Assembly, to which he was consistently re-elected. These actions had a good deal to do with the outbreak of the Rebellion of 1837, and after the disorders of that period had died down little more was heard of restrictions on the liberty of the press. In 1938, however, the province of Quebec adopted the so-called Padlock Law which enables the attorney general to close at his discretion any building which he finds to be used for Communist propaganda, and some years later the same government authorized him to seize copies of any periodical offending against certain standards of decency. The Quebec Board of Censors has prohibited the showing of the films *Enfants du Paradis* and *Martin Luther*.

Problems of the Future.—The 19th century liberal attitude towards censorship rested on the assumption that the interests of the competing owners of the means of dissemination would, if not interfered with, bring about an adequate "diversity of access" to the means of communication. Liberals in the 20th century are inclined to question that assumption, especially in regard to the mass media of radio, television, and the motion picture, on the ground that ownership is becoming too centralized and competition does not operate as it once did. Daily newspapers are diminishing in numbers in all English-speaking countries, and the remainder are being more and more organized into "chains," under one ownership or direction. Radio and television stations are usually affiliated to one or another of the networks. The financial relations between newspapers, radio, and television are very intimate. The motion picture industry is highly centralized. Morris L. Ernst in *The First Freedom* says that the high prices for time on radio stations "seriously prevent diversity of access to the ether." The *Code of the National Association of Broadcasters* (1939) says that "Time for the presentation of controversial issues shall not be sold except for political broadcasts"; this is to prevent embarrassing demands for time for a reply. Under this regulation labor, with no political party and with three rival organizational groups, has little chance of presenting its message on the air.

Proposals for remedying this condition have ranged from legislative dissolution of all large combinations in the communications business to the placing of radio and television under the free speech guarantee. Even if all the chains and networks were dissolved there would still remain the highly centralized influence of great advertisers, who can hardly be expected to be favorable to all types of controversial material. As regards the radio-newspaper relation, it is significant that the Canadian Broadcasting Corporation, though instructed by Parliament to favor separation, in practice often finds the local newspaper the best applicant for a license, in respect of ability to provide good service. To retain its advertisers the radio station must retain its listeners, and it is unlikely that under any type of control it could afford to devote much time to controversial material of a possibly unpopular type. Yet the British solution, of public ownership and control and no advertising on radio,¹ is scarcely likely to satisfy the American listener; and even the British method is not an absolute guarantee of diversity of access—the ability of all shades of opinion to reach the public by all media.

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B. K. SANDWELL,

Editor Emeritus, "Saturday Night," Toronto.

¹ On June 30, 1954, the British government permitted advertising on television, limited to the time between programs and involving no sponsorship of programs.

CENSURE, in canon law, a spiritual penalty whereby a contumacious offender is denied the use of certain spiritual goods. It has three degrees—excommunication, suspension, and interdict. By excommunication the offender is cut off from association with the faithful whether in spiritual things or in secular; by suspension a minister of the church, a cleric, is deprived of the right to exercise the functions of his station; by interdict the services and ministrations of the church are denied to an offender—the sacraments and the right to Christian burial. An interdict may affect places as well as persons; it may be laid on a church edifice or a burial place. Censures are the penalties prescribed in the church's law for definite offenses, and some censures fall upon the offender, *ipso facto* or *ex ipso jure*, without need of a judgment being pronounced by church authorities. Such a censure is said to be *latae sententiae*, that is, providing for its own carrying out; but most censures are *ferendae sententiae*, requiring that the sentence be pronounced by some proper authority, as the bishop of a diocese or his deputy. And absolution from some censures *latae sententiae* is reserved to the supreme pontiff, while absolution of other censures can be given by bishops, or other pastors, either in the ordinary course of their jurisdiction or in virtue of special faculties accorded to them to that end. An example of a censure, release from which is reserved strictly to the supreme pontiff himself, is the censure of excommunication incurred by whoever violently assaults a cleric or a member of a religious order (*clericus vel monachus*); but an exception is made of the case where the offender is in danger of death.

CENSUS. The practice by governments of enumerating populations under their jurisdiction and of taking account of the economic assets and social characteristics of the people has become a highly scientific operation in modern times. Today, more than 80 countries of the world conduct censuses of varying frequencies. Under the leadership of the United Nations throughout the world, and specifically of the United States in the Americas, efforts to coordinate the timing of censuses have met with some success. More than 60 nations now are cooperating in development of time schedules and minimum standards, although there is still a wide variance among censuses in method and quality. Sufficient progress has been made, however, to enable demographers to arrive at a reasonably acceptable population total for the world, approximately 2½ billion human beings. This figure is based in large part on enumerations and for the rest on carefully constructed estimates. The importance of maintaining current vital statistics (natality and mortality data) to determine rates for measuring trends with reference to fixed censuses also has gained universal recognition.

HISTORY OF CENSUS-TAKING

The word *census* is derived from the Latin, *censere*, to value or tax. Roman magistrates, known as *censors*, were charged with making a register of the people and of their property, at five-year intervals, for the purpose of imposing taxes and to determine the number of males available for military service. Servius Tullius, the sixth king of Rome (578–534 B.C.), instituted the Roman census. Caesar Augustus, in 5 B.C., extended the census to include the entire Roman

Empire, and it was for the purpose of registering in such an enumeration that Joseph and Mary had come to Bethlehem when the infant Jesus was born.

The Earliest Surveys.—Censuses, in the form of cadastral surveys, had their beginning, however, long before the founding of Rome. References to the earliest of such surveys are vague. Ancient Babylonia, China, and Egypt had such accountings 30 centuries before the birth of Christ. Herodotus told of such undertakings in the valley of the Nile and in ancient Persia.

The Book of Numbers in the Old Testament is a form of census record. At the time of the Exodus (c.1500 B.C.) Moses enumerated the fighting men of Israel and the priestly Levites. Five centuries later, King David ordered the unwilling Joab to make a count of the Israelites to determine the number of his swordsmen. Biblical history states that this enumeration caused divine wrath to be visited upon the people, and this account provided a basis in later centuries for public resistance to censuses. Obviously, the fact that these earlier censuses were preliminary to military drafts and tax assessments had something to do with this resistance. In Rome, for instance, the censors ordered the observance of the *lustrum*, a feast of purification dedicated to the war god, Mars, at the conclusion of each census. The last *lustrum* was conducted in the year 74 A.D.

The collapse of the Roman Empire brought an end to the first known series of periodic censuses. The feudal system which followed rendered the revival of census-taking, even when practicable, less necessary. The *Breviary* of Charlemagne (c.808 A.D.) was one of the medieval efforts to revive such accountings. In the *Domesday Book* (1086 A.D.) William the Conqueror set up a census-like record of the names of English proprietors with a description of their lands, extent, value, and liabilities. The *Domesday of St. Paul's* (1181 A.D.) is another example. Genghis Khan caused censuses to be made of the people and possessions in territories overrun by his armies during the latter years of the 12th century and the early decades of the 13th century, and records dating from 1370 A.D. reveal detailed plans for a census in China, although it is not certain whether this census was completed. One of the earliest complete censuses of a city, involving inhabitants of all age groups, was taken in Nürnberg in 1449. Other provincial or municipal censuses were taken in Switzerland in the 15th and 16th centuries.

Western Hemisphere.—The first census in North America, of Spain's American possessions, was taken in 1576 at the behest of King Philip II of Spain. The Spanish overlords entrusted this task to the natives, and the report made by the Indian scribes is now in the University of Texas Latin-American Library.

Peruvian statisticians, however, have claimed recognition for their country as the locale of the earliest known censuses in the Western Hemisphere. This claim is based on the surviving records of the ancient Inca civilization in Peru and on historical writings of the Spanish conquerors who followed in the wake of Columbus' explorations. Records have been cited to show that the ancient Peruvians made a register of men for military purposes and reported their number to the Inca emperor, Sinchi Roca, as 200,000 fighting men.

Long before Columbus' voyage and the conquest of Peru by Pizarro, the Inca rulers appeared to have established extensive organizations devoted to reporting statistical information about their subjects and the resources of the Inca empire. Having no system of writing, the ancient Peruvians used the "quipus" to record census information. This contrivance consisted of a main cord from which hung, at certain distances, smaller cords of various colors, each having a special meaning (as red for soldiers, yellow for gold, white for silver, or green for corn). Knots were tied in the smaller cords representing definite numbers.

The first post-Columbian census in the Americas also had Peru as its base of operations. This census was conducted in 1548 by the Spanish viceroy, Don Pedro de la Gasca. This census and a second one in 1606 are described in an article by Carlos A. Uriarte, chief of the Demographic Statistics Department, National Directorate of Statistics of Peru, published (March 1949) in *Estadística*, official organ of the Inter American Statistical Institute.

American Colonies.—The first of the North American colonies to take a census was Virginia, in 1624–1625; a second census, taken in 1634–1635, enumerated 5,119 persons. The next colonial census was that of New York Colony, in 1698, which enumerated 18,067 inhabitants. These Virginia and New York censuses were the only colonial censuses to be taken during the 17th century in what is now the United States. Between 1700 and 1790, when the first United States census was taken, there were 36 additional colonial censuses. Nearly all of the American colonial censuses were taken at the behest of the British Board of Trade, which desired definite statistical information about the colonial market.

The colonial authorities of New York and Rhode Island developed the greatest aptitude for census-taking. Of the 38 colonial censuses before the 1st decennial census of the United States in 1790, nearly half were made in these two colonies—11 in New York, and 7 in Rhode Island.

Maryland took its first colonial census in 1712, with an enumeration of 46,073, and another in 1755. New Jersey was the fourth of the colonies to comply with orders that a census be taken, enumerating 32,442 inhabitants in 1726. The colonial governor had refused three years earlier to take the census as demanded by the British Board of Trade because "the people would take it as a repetition of David's sin." Upon the board's insistence, however, he issued orders to the sheriffs to take the census; and in all, three colonial censuses were subsequently taken in New Jersey.

The people of Connecticut and Massachusetts manifested considerable opposition to census projects. They feared that in some way the information gathered in censuses would be used to their disadvantage by the British authorities and saw no advantage to themselves. The first census including all the inhabitants of Connecticut was taken in 1756, while Massachusetts delayed until 1764 when the general court, after repeated demands from the colonial governor and fearing further to irritate British authority, ordered a general census in which Maine was included as a part of Massachusetts.

New Hampshire's first colonial census was taken in 1767 with a count of 52,700 inhabitants.

The colony took three additional censuses. One of these, in 1775, was taken to ascertain the quantity of arms and ammunition in the province and to correct (according to the 1909 report of *A Century of Population Growth*, issued by the United States Bureau of the Census) a "wild" estimate made by the Continental Congress of 102,000 inhabitants, exclusive of slaves.

Pennsylvania and Delaware, as well as the Southern colonies of Georgia and North and South Carolina, conducted no colonial censuses, as far as records show.

Canada.—Canada has advanced a claim to the first census in the modern manner with the enumeration in 1666 of the Colony of New France. This census provided a record of every person by name, on a fixed date, showing the age, sex, place of residence, occupation, and conjugal status. The original document of 154 pages, listing 3,215 individuals, is in the Archives of Paris. Thirty-seven complete and nine partial censuses were taken during the French regime; and these included data on agriculture, public building, sawmills, and other matters. Canada began taking a regular decennial census in 1851. Yearly estimates are made of the total population and that of each province. (See also CANADA—*Population*.)

Europe.—In the Scandinavian countries, the first of the modern censuses was taken in Iceland in 1703, but publication was delayed many years. For this reason, the Swedish census of 1750 (following the establishment of parish registers in 1686 and a supplementary law in 1748 which required parish tables to be kept on births, deaths, and total population) is regarded as the first which, since its inception, has constituted a regularly taken and periodically published population record. It is, like other Western European censuses, made up from the parish registers, a procedure recommended by Bishop Berzelius, one of the founders of the modern science of statistics. The founder of actuarial science, Richard Price, used the Swedish registry data to compile the first life insurance tables.

Various other partial censuses were taken in the 1700's, among them one in Austria in 1754, two in Spain in 1769 and 1798, and one each in Norway and Denmark in 1769. These were neither complete nor reliable, however. The first modern census in Prussia was taken in 1810; Norway, in 1815; Austria, in 1818; Greece, in 1836; Belgium, in 1846; Italy, in 1861; and Russia, in 1897. Actually, in Russia, a census had been ordered every 20 years after 1722. This was observed until 1782, and another was taken in 1796; but it was not until 1802 that a central bureau was established, after which Russian censuses were taken in various years prior to 1897.

Meanwhile in Great Britain various population counts had been made, although none had the characteristics of a general census. In 1791, Sir John Sinclair had undertaken to compile a census of the population, agriculture, trade, and industries of the entire kingdom by inquiries sent to the clergy of the Established Church. In 1798, 21 volumes of the results of this survey were published. His work led to Parliament's decision in 1800 to establish a census office, and Great Britain's first population census was taken in the spring of 1801. Britain's first census of agriculture and industry was not taken, however, until 1907.

France, also, took her first census in 1801, and another in 1806; but it was not until 1836 that reliable census-taking methods were adopted in that country.

THE UNITED STATES DECENNIAL CENSUS

The census in the United States had its inception as an integral part of the machinery of government. The Constitution provides that an enumeration of the population "be made within three years after the first meeting of the Congress of the United States and within every subsequent term of ten years" (Article I, Section 2). Such an enumeration is needed to determine the population of the various states, so that representatives in Congress can be apportioned among the states in proportion to their population.

The decennial census of the United States is the first of the modern censuses to be repeated at regular periodic intervals. Without lapse, the census of population has been taken at 10-year intervals since 1790. The first census of manufactures came in 1810, while the census of agriculture was initiated in 1840, the census of business was inaugurated in 1930, and the census of housing was first taken in 1940.

The 1st decennial census of the United States (1790) enumerated a population of 3,929,214. At that time a classification of the population was necessitated by the constitutional requirement that only three fifths of the slaves be included in the population count to be used for apportionment or representatives. It was also found desirable at this census to divide the free population into white males under 16, white males 16 and over, white females, and other free persons. The entire report of the first census is contained in a volume of 56 pages.

The third census (1810) marked the first attempt to gather industrial statistics, although the returns were not considered entirely satisfactory. In 1830, for the first time, the assistant marshals were given printed schedules—an important step toward unifying the method of reporting. The sixth census (1840) marked the first systematic attempt to collect a general body of usable statistics on the activities of the population; its defined objective was to cover such information on population, mines, agriculture, commerce, manufactures, and schools "as will exhibit a full view of the pursuits, industry, education, and resources of the country." Errors in the census reports led to a congressional investigation, and partly as a result of that investigation, the gathering of information for the seventh census (1850) was radically changed. This was the first census to list by name every inhabitant of the country. It provided also for data on age, sex, color, place of birth, marital status, and other facts about individuals.

Census-Taking Methods.—The first 12 censuses of the United States, 1790–1900, were conducted without benefit of a permanent census office, notwithstanding the fact that a cadre of professionals developed. After the 1900 census, Congress enacted the Permanent Census Act creating the Bureau of the Census on March 6, 1902. First established in the Department of the Interior, it was transferred to the Department of Commerce and Labor in 1903, and remained in the Department of Commerce after 1913 when a separate Department of Labor was formed.

The field supervisors for the first nine censuses, 1790–1870, were the marshals of the United

States judicial districts, and the enumerators were the deputy marshals. The census of 1880 marked a major improvement in the method of collecting information. From that year, the temporary field organization was discontinued on the old judicial district lines and was set up more nearly in the present manner. The number of employees was increased in an attempt to complete the enumeration in one month instead of the 10 to 20 months which had been required for previous censuses, thus making the information conform more nearly to the census date. Since 1940, the Census Bureau has maintained a nucleus field organization to conduct special surveys, and around this organization the temporarily expanded field force was built for the 1950 census.

As a result of the establishment of the Census Bureau as a permanent statistical gathering agency, the efficiency of census-taking and of the tabulation and publication of results has shown continued improvement. Notable has been the lightening of the peak load of work, coinciding with the decennial census years, by the allocation of portions of the original decennial censuses to other years; and the increase in frequency of canvasses in the fields of industry, distribution, and agriculture to provide more current statistical information.

Tabulating Equipment.—Notable also has been the improvement in census-taking techniques, the development of sampling on a scientific basis, the invention and improvement of tabulating equipment, and the application of the principles of electronics in new statistical computing machines. The year 1951 marked the completion of the construction for the Census Bureau, under supervision of the U.S. Bureau of Standards, of an electronic device, the Universal Automatic Computer, called the UNIVAC. This machine represents the first in the field of electronic computing machines for statistical use as opposed to use for the solution of complicated mathematical formulas. It was designed and constructed to meet the specific problems of the Census Bureau in recording, computing, and interpreting mass statistics at high rates of speed. The UNIVAC supplements, and eventually is expected to replace, much of the card tabulating equipment which represents the modern form of the first tabulating machines designed for the Census Bureau by Herman Hollerith and subsequently improved by E. M. LaBoiteaux and James Power.

The invention and improvement of computing and tabulating equipment has created a demand for more effective and adaptable schedules. In this field, the use of "mark-sensing" cards and procedures in Canada and Denmark is of the greatest current interest.

Special Censuses.—Since 1900, censuses in certain fields have come to be taken more frequently than decennially. The census of manufactures was taken in the United States at five-year intervals from 1900 to 1920 and at two-year intervals through 1940. After a lapse during World War II, the most recent industrial census was taken in 1948, covering operations in 1947. Since 1920, the census of agriculture has been taken every five years. The census of business, taken as part of the 1930 and 1940 decennial censuses, was repeated in 1949. Recent legislation provides that the census of business, together with the census of manufactures, a census of transportation, and the census of mineral industries recur at five-year intervals beginning in

1954. This removes the load of business and industrial censuses from the peak-year period of the population census. Other decennial censuses removed from the "0" years are the census of governments, which collects statistics of state and local governments. On the basis of legislation enacted in 1950, this census is to be taken at five-year intervals beginning with 1952. A new census of religious bodies, one of which was taken in 1936, was scheduled for 1956.

In addition to the decennial censuses, the Census Bureau compiles comprehensive statistics at annual, quarterly, and monthly intervals in the fields of employment, unemployment, manufacturing, retail and wholesale trade, exports and imports, financial statistics of states and cities, and other subjects for which current statistical needs arise.

The 1950 Census.—The 1950 census was the largest population, housing, and agricultural inventory ever undertaken by the United States. The field organization consisted of 14 area offices, each in charge of district field offices in a group of states. There were 457 district field offices established largely along congressional district lines. Under the district supervisors was a force of 8,300 crew leaders and 140,000 enumerators. These field workers traveled an estimated 25 million miles in visiting every dwelling place in the nation's 4,270 urban places and in the rural areas of the country. Final returns showed 150,697,361 inhabitants in continental United States as of April 1, 1950.

**POPULATION OF CONTINENTAL
UNITED STATES: 1790 TO 1950**

Census year	Population	Number	Percent
1790	150,697,361	19,028,086	14.5
1840	131,669,275	8,894,229	7.2
1890	122,775,046	17,064,426	16.1
1920	105,710,620	13,738,354	14.9
1910	91,972,266	15,977,691	21.0
1900	75,994,575	13,046,861	20.7
1890	62,947,714	12,791,931	25.5
1880	50,155,783	10,337,334	26.0
1870	39,818,449	8,375,128	26.6
1860	31,443,321	8,251,445	35.6
1850	23,191,876	6,122,423	35.9
1840	17,069,453	4,203,433	32.7
1830	12,866,020	3,227,567	33.5
1820	9,638,453	2,398,572	33.1
1810	7,239,881	1,931,398	36.4
1800	5,308,483	1,379,269	35.1
1790	3,929,214		

* Revised figure.

UNITED STATES BUREAU OF THE CENSUS

The Census Bureau is the agency responsible for the conduct of the major censuses and for the compilation and publication of many other reports that are of widespread use, and that can be collected or compiled with exemplary economy by the census organization.

In addition to its responsibility for the collection of basic statistical information under specific census legislation, the Census Bureau plays an important role as a statistical service agency for other branches of the federal government. During the years of preparedness for and conduct of World War II, the Census Bureau collected and tabulated statistical information for the War Production Board, the Office of Price Administration, and a number of other defense and military agencies. Under the authority given the Bureau of the Budget in the Federal Reports Act, the Census Bureau has been designated as the collecting agency in surveys designed to

provide statistical information on special subjects for other departments. With the resurgence of national defense activities following the outbreak of fighting in Korea in June 1950, the Census Bureau again was called upon to perform special statistical services for national defense agencies such as the National Production Administration, the Civilian Defense Administration, the Department of Defense, and others.

Many nongovernmental agencies also avail themselves of special services performed by the Census Bureau. Tabulations of census data in special arrangements desired by businessmen are made on an actual cost basis. The same type of service is offered governmental agencies on the local level.

Another of the more important services maintained by the Census Bureau is that of searching old population census records to provide individuals with transcripts of personal information to assist them in establishing their age, citizenship status, or other characteristics. This information is supplied only to the individual to whom it relates or his authorized representative, since all information in census records is confidential. The principal demand for personal census transcripts stems from the enactment of the Social Security Act in 1935. Since about 50 million older Americans do not have birth certificates because most states did not have birth registration systems until after the turn of the century, the importance of census records as a source of evidence regarding age for individuals reaching 65 years of age and seeking to qualify for social security benefits is obvious. Requests for personal transcripts of census records average about 100,000 per year. In one year however, during the period of World War II, more than 700,000 such requests were serviced at a time when employment on defense projects was limited to citizens. Transcripts of census records were accepted as proof of such citizenship; in most cases, such transcripts were the only official data available.

Reports to the Census Bureau are made for statistical purposes only. No information about any individual person or form can be obtained from any census publication. All data are collected by the bureau for statistical purposes so that the American people can have an accurate picture of the economic, social, and political condition of the nation.

Statistical Services of Other Federal Agencies.—The Census Bureau is by no means the only agency of the federal government which collects data and issues reports of a statistical nature. Statistical publications of basic importance in specialized subject fields are issued by many other government departments and bureaus. To name a few, current estimates of crop acreages and production, and many other related data, are produced by the Bureau of Agricultural Economics of the Department of Agriculture. The Bureau of Labor Statistics of the Department of Labor issues figures on prices and compiles many other statistics concerning, or of interest to, labor. Further, various administrative agencies, such as the Social Security Administration and the Civil Service Commission, publish statistical reports. The Federal Power Commission provides current statistics in its field, and the Interstate Commerce Commission performs a similar service with respect to railways. Finally, the entire statistical program of the

federal government is reviewed and coordinated by the Division of Statistical Standards of the Bureau of the Budget.

Census Bureau Publications.—Reports of the 17th decennial census are embodied in a series of bulletins for each state, a series of bulletins on selected subjects, and a series of United States summary bulletins. Final bound volumes, usually a separate one for each state, and one for the United States, consolidate geographical area bulletins under single covers. After each decennial census, the Census Bureau publishes a *Catalog of Decennial Census Publications*. It also publishes quarterly, with an annual consolidation, a *Catalog and Subject Guide to Census Publications*, listing and describing the contents of all census reports currently published.

The *County and City Data Book, 1949* brings together 101 items of information for each state, each county, and each standard metropolitan area, and 92 items for each of about 400 cities having 25,000 or more inhabitants in 1940. Broad subject fields covered include the 1948 census of business, 1947 census of manufactures, 1945 census of agriculture, and (preliminary) 1950 census of population.

In addition to these general publications, there are available interim and final reports of the various recent censuses and surveys in the fields of manufactures, retail and wholesale distribution and service trades, agriculture, foreign commerce, state and local government finances and public employment, current population statistics including data on employment and unemployment, and other

the *Labor Force*, the *Current Population Reports*, and *International Population Reports*, the last-named two series being issued at frequent but unspecified intervals.

Most of the reports of the Census Bureau are available in public libraries and in field offices of the Department of Commerce. Copies of these reports may be purchased from the Superintendent of Documents, U.S. Government Printing Office, Washington 25, D.C., or from Commerce Department field offices. Requests for information on obtaining copies of unpriced census publications should be addressed to the director, Bureau of the Census, at Washington.

ROY V. PEEL,

Director, Bureau of the Census.

CENT, a United States coin and money of account, the 1-100 of a dollar. The convenience of decimal computation has caused in various countries the division of the monetary unit into hundredths, with names derived from Latin *centum* or its adjectives; as the French franc into centimes, the Dutch guilder into cents, the Italian lira into centesimos, the Spanish-American dollar into centavos, etc. Thomas Jefferson regularly used cent to mean the hundredth of any unit of measurement; but in its first suggestion for our coinage it meant 100. The inconvenience of the English system being felt, Congress in 1781 instructed Robert Morris to devise a system of national coinage; and he proposed a unit of $\frac{1}{4}$ grain of silver (or 1-1440 of a Spanish dollar, familiar in the colonies), of which 100 were to make a cent (about 7c. of ours), 500 a quint (34.7c.), and 10,000 a mark (\$6.94). Jefferson proposed instead the dollar as a unit, the smallest coin to be of copper and 1-200 of it (that is, the old English farthing, our half-cent); this was adopted July 6, 1785. But on Aug. 8, 1786, an act was passed, still modeled by Jefferson, to coin a cent, of which 100 were to weigh $2\frac{1}{4}$ pounds avoird-

pois (157.5 grains each), and be equal to a dollar, and a half-cent proportionate. This was the first use of the name in our coinage, and doubtless represents Jefferson's "hundredth." The "cents" prior to this have not that name on them, and are really English halfpence. The difficulty of displacing a popular name is shown by that of "penny," which still clings tenaciously though absurdly to our cent, only half its value. Congress in 1787 established a mint in New Haven, and for years coined there the "Fugio" or "Franklin" cents, familiar to collectors. But from 1785 to 1788 several states coined copper cents on their own account. Vermont (not yet admitted) began in June 1785; Connecticut in October 1785; Massachusetts late in 1786 (real half-cents); New York, 1786; New Hampshire (coppers 15 to the shilling). Under

the constitution the first coinage act was passed April 2, 1792, and raised the weight of the cent to 11.52 grains, but on Jan. 14, 1793, it was re-

duced to 10.89 grains, and the half-cent always being proportional. The first coinage under the new act was in 1793. This old-fashioned "copper" remained unchanged except in pattern till 1857, and its forms from 1793 to 1857 are of seven types: (1) 1793, chain or link around the word "cent"; (2) 1793, wreath in place of chain; (3) 1793-1796, liberty cap on pike over left shoulder of "Liberty"; (4) 1796-1807, "Liberty" with draped bust; (5) 1808-1814, filleted head with 13 stars. (6) 1816-1839, plain coronet with coiled hair.

Those of 1793, 1799, and 1804 are very rare, as are also the copper cent of 1856 and the half-cents of 1793, 1831, 1840 to 1848 and 1852. On March 3, 1851, a 3-cent piece was authorized, of $12\frac{1}{2}$ grains, 75 per cent silver, 25 copper, legal tender to 30 cents; on March 3, 1853, it was raised to .900 fine, but reduced to 11.52 grains, $\frac{3}{50}$ of the half-dollar. On Feb. 21, 1857, the half-cent was abolished and the old cent replaced by a smaller new one, of 72 grains, .88 copper and .12 nickel. On April 22, 1864 this was supplanted by a bronze cent, 48 grains (the present one), .95 copper and .05 tin and zinc, legal tender to 10 cents; and a bronze 2-cent piece, twice its weight and legal tender. On March 3, 1865 a 3-cent piece was authorized, $\frac{3}{4}$ copper and $\frac{1}{4}$ nickel, 30 grains, legal tender to 60 cents; but the ones and twos were made legal tender to only four cents. On May 16, 1866 a 5-cent piece (the nickel) was authorized, same material as the 3, 77.16 grains, legal tender to \$1. On Feb. 12, 1873, all cents and their multiples were discarded except the 1, 3 and 5, as above, each to be legal tender to 25 cents; and on Sept. 26, 1890, the 3-cent piece was discarded. See also COINAGE OF THE UNITED STATES; NUMISMATICS.

CENT, a name given under the old Germanic constitution to a small portion of territory. Each province or district was subdivided into so many cents and was placed under the special jurisdiction of an overseer or centenarius. The name corresponds with hundred as in English territorial division.

CENT-GARDES, *san-gerd*, (Fr. "The Hundred Guardsmen"), a body-guard acting in the service of the French king during several centuries. See GUARDS.

CENT JOURS. See HUNDRED DAYS.

CENT NOUVELLES NOUVELLES, *Les, sãn nōō-věi'*, a collection of facetious tales, first published at Paris in 1486 by Antoine Vérard from a manuscript written in 1456. They were told at the table of the dauphin, afterward Louis XI, in the castle of Genappe (Belgium) during his exile. The arrangement in their present form has been attributed to Louis himself and to Antoine de la Salle. The historical importance of the collection arises from its details regarding manners and customs of the 15th century that can be found nowhere else. Among the narrators are obscure and untitled men, probably domestics of the duke of Burgundy, who figure side by side with some of the greatest names in French history. The collection was edited by Thomas Wright in two volumes (Paris 1858), and a smaller edition was published by Pierre Champion (Paris 1928).

CENTAUREA, *sãn-tō-rě'a* (including BACHELOR'S BUTTON or CORNFLOWER, DUSTY MILLER, KNAPWEED, STAR THISTLE, SWEET SULTAN, RAGGED ROBIN, RAGGED SAILOR), a genus of annual, biennial, or perennial herbs of the Compositae (Composite) family, with alternate, or all basal, entire to pinnatifid leaves, and solitary to numerous, small to large, heads of flowers. Many of the species are widely used in ornamental gardening.

The following are among the popular garden sorts: *C. Cyanus*, the bachelor's button or cornflower, common in Mediterranean grain fields and frequently established in America, whose blue flowers yield a blue dye; *C. Cineraria*, the dusty miller, from southern Italy and Sicily, with white hairy leaves; *C. moschata*, sweet sultan, from the Orient, widely grown for its large, fragrant flower heads; *C. montana*, mountain bluet, which originally had blue flowers, but developed various other tints under cultivation.

All the species are easily grown from seed and thrive in any good garden soil. *C. solstitialis*, the yellow star thistle, blooms from July to September and offers bees a continuous flow of honey. The Napa thistle or tocalote, *C. melitensis*, blooms earlier and yields a light amber honey in May and June, but is a pernicious weed in cultivated fields and is widely distributed in California. The Russian knapweed, *C. repens* (*C. picris*), is another pest which annoys the farmer while offering a harvest to the beekeeper. The virgate star thistle, *C. virgata*, variety *squarrosa*, appears as a pest in sheep pastures in California, where sheep and cattle will not eat it.

Consult Pellett, F. C., *American Bee Journal*, vol. 91, No. 103 (Hamilton, Ill., 1951); Bellue, M. K., "Virgate Star Thistle, *Centaurea Virgate*, var. *Squarrosa*," State of California Dept. of Agriculture, *Bulletin*, 1952, vol. 11, No. 2, pp. 61-63 (Sacramento 1952); Gleason, H. A., ed., *The New Britton and Brown Illustrated Flora*, vol. 3, p. 513 (New York 1952).

ARTHUR GRAVES.

CENTAURS, *sãn'tōrz*, in Greek mythology, a fabulous race dwelling originally in Thessaly and later in the Peloponnese. According to one of many fables, they sprang from the union of Ixion and a cloud. They are said to have been half horse and half men, and the fable is explained by the surprise of the Greeks on encountering the wild horsemen of northern tribes. Mythology relates the combats of centaurs with

Hercules, Theseus, and Pirithous. The last, at the head of the Lapiths, another Thessalian people and their hereditary enemies, entirely defeated the centaurs, killed many, and drove them from Thessaly. See also CHIRON; DEIANIRA; HERCULES; NESSUS.

CENTAURUS, *sãn-tō'rūs*, or **THE CENTAUR**, a southern constellation, only a small part of which is visible in northern latitudes. It received its name in antiquity from its stellar resemblance to the mythical centaurs (q.v.). The constellation is large and contains many bright stars, including Alpha and Beta, both of the first magnitude. The former, the third brightest star known, is the nearest bright star to Earth—its distance being only slightly greater than that of a small companion known as Proxima Centauri. Alpha itself has a parallax of 0.75, which gives a distance of $4\frac{1}{3}$ light years. It is also a famous double star, its period being 80.1 years, and the



The constellation Centaurus.

masses of its components being 1.10 and 0.94 that of the Sun. The brighter component has the same spectral class (GO) as the Sun, which it resembles in every respect.

The constellation contains the globular cluster known as Omega Centauri, visible to the naked eye as a faint star. It is composed of thousands of stars and is probably our nearest neighbor among such clusters, being about 21,000 light years distance. If our Sun should be set in this cluster, it would be just at the extreme limit of the 100-inch telescope; hence most of the 6,000 stars so far seen therein must be considerably more luminous.

CENTAURY, *sãn'tō-rĩ*, common name for a genus of plants, *Centaureum* (sometimes known also as *Erythraea*), belonging to the family Gentianaceae. A few species are cultivated in rock gardens, usually as annuals, for their attractive flowers, commonly in shades of pink. The species are widely distributed: those in cultivation include *C. Massonii* from the Azores, *C. conferta* from Europe, *C. Beyrichii* from the southern United States, and *C. venustum* from California. Other species grow wild in the United States, especially in the West. A European centaur has been used medicinally, chiefly in home remedies, as a bitter tonic, for dyspepsia and other ailments. *Sabatia stellaris*, a related plant, is called American centaur by materia medica because of its similar use, but it is perhaps better known as the marsh pink. Another genus of plants, *Centaurea* (q.v.), of which the cornflower or bache-

lor's button and the sweet sultan are members, should not be confused with *Centaurium*.
N. HIGINBOTHAM.

CENTAVO, sên-tă'vô, a minor coin, a hundredth part of the monetary unit (usually the peso) of Mexico, other Latin American countries, and the Philippines. The Portuguese centavo is the hundredth part of an escudo.

CENTENARY, sên'tê-nê-î (from Lat. *centenarius*), a period or age of 100 years; also the commemoration of an event, such as a great man's birth or the founding of a city or nation, which occurred 100 years previously. The synonym "centennial" is often used; thus the Centennial Exhibition commemorates the birth of the United States, and the "Centennial State" is a nickname for Colorado, which was admitted to the Union in 1876.

CENTENARY COLLEGE, Shreveport, La., a state institution originally founded in Jackson, La., in 1825. This school, which at first was called the College of Louisiana, was discontinued in 1845, and its buildings and charter were promptly acquired by Centenary College, which had been established in 1839 by the Methodists of Mississippi in celebration of the one hundredth anniversary of the founding of their denomination.

Before the Civil War it was one of the leading colleges of the South, but the four years of war (1861-1865) and the ensuing reconstruction era made survival difficult. In 1908 the school, which for some years had belonged to the Methodist Conference of Louisiana, was moved from Jackson to Shreveport, a thriving commercial city in the northwestern corner of the state. Its annual enrollment exceeds 1,000.

The academic courses are administered by the dean of the college through three general divisions of study—humanities, natural sciences, social sciences—and the departments which they include. The college also conducts a school of music on the campus.

The institution, which is coeducational, grants the bachelor's degree in arts, science, and music, and provides courses in many fields for students who later enroll in professional schools.

ARTHUR MARVIN SHAW.

CENTENNIAL STATE, a popular name given to the State of Colorado on account of its admission to the Union in 1876, the one hundredth year of the independence of the United States.

CENTENO, thên-tă'nô, Diego, Spanish soldier: b. Ciudad-Rodrigo, León, Spain, 1505; d. La Plata, Peru, 1549. As a member of Pedro de Alvarado's expedition to Peru, he won renown. In 1544 he sided with the viceroy, Vela Blasco Nufiez, against Gonzalo Pizarro, brother of the conqueror Francisco, upholding the royalist cause in the conflicts for power. He was defeated by Gen. Francisco de Carvajal and fled to the Pacific. A year later he again raised the royal standard, combining with Pizarro's chief in La Plata, and met Carvajal in a great battle in the Province of Charcas, where he was defeated. This was not a final defeat, for Pedro de la Gasca, envoy of Charles V of Spain, made him governor of La Plata, and the king ennobled him.

CENTENO VALLENILLA, sân-tă'nô vâ-yâ-nê'yâ, Pedro, Venezuelan diplomat and artist: b. Barcelona, Venezuela, June 13, 1904. After obtaining a degree in law at the University of Caracas in 1923, he served for four years as attaché of the Venezuelan legation in Rome, and from 1927 for over a decade as secretary of his nation's legation to the Holy See. An accomplished painter, he exhibited in several Italian expositions, including the Bienale Romana in 1924 and the Amatori e Culturi d'Arte (Rome 1926). His work was shown also in several personal exhibits in Caracas, Paris, and Rome. Among his notable paintings are *Bolívar en Roma*, *Impressions de Grèce*, *Mélancolie indienne*, *Gaïn et Abel*, *Muchacho caribe*, and *Netzahualcoyotl*.

CENTER, city, Texas, seat of Shelby County. At an altitude of 345 feet, it is 55 miles south of Marshall on the Gulf, Colorado and Santa Fe Railway and is served by national roads. It has fine old houses of the period of the Republic of Texas. Its industries include lumber, broom, and cotton-gin manufacture, and mattresses. In 1866, when it was decided that a county seat should be as nearly in the center of a county as possible, it was chosen for the honor. It was incorporated in 1903 and is governed by a mayor and council. Pop. (1950) 4,323.

CENTER, The, a political party organized in Germany in the 19th century as Roman Catholic opposition to governmental restrictions; later, a party expressing strong Catholic sentiments with a strange mixture of antiauthoritarianism and zeal for social reform. Its adherents cut across social and economic lines. Its appeals were so diverse that it received the appellation Center, or *Zentrum*. During the years of the Weimar Republic (1919-1933) it furnished several prime ministers and was always represented in the cabinet. Its strength at the polls remained about one seventh of the total vote. In Bavaria there was a separate and a stronger wing of the party than in other parts of Germany.

When Hitler was in power (1933-1945), all competing parties were eliminated. After World War II the party was revived and, with its sharp denunciation of communism, drew some Protestant support. Under the name of the Christian Democratic Union (and in Bavaria the Christian Social Union) it became the dominant political force in the West German Republic, with Konrad Adenauer as chancellor.

Catholic parties in Italy and other Continental countries have been referred to as The Center, with programs resembling those of the German *Zentrum*. Since World War II, Center parties have been stronger than formerly.

SPENCER D. ALBRIGHT,
Department of History and Political Science, University of Richmond.

CENTER OF BUOYANCY. The center of buoyancy of a floating body is that point within its boundaries corresponding to the center of gravity of the volume of water or other fluid which is displaced. It is customary to regard buoyancy as a force acting upward and opposed to gravity. This is not in accordance with fact, for all the phenomena of floating in water, air, or other fluids are due entirely to the attraction of gravity, which acts constantly downward. (See HYDROSTATICS.) When a body floats in water, it

sinks into the water and toward the center of the earth only to the extent where the earth's attraction for the body and its attraction for the volume of displaced water are equal at that level. And as the weight of a body is the measure of the earth's attraction for it we say a floating body displaces its own weight of water. A floating body will therefore sink into water only to a point where the water beneath it is attracted toward the earth's center more forcibly than is the floating body. The same phenomena may be observed in the case of a balloon. The balloon filled with a gas that is lighter than air at the sea level will rise to a position where the earth's attraction for the balloon and its attraction for the volume of air displaced by the balloon are exactly equal. The center of buoyancy of the balloon is the center of gravity of the body of air displaced by the balloon.

When the center of gravity of a floating body is below its center of buoyancy (equivalent to its point of support—see **EQUILIBRIUM**), the body will float in stable equilibrium. When the center of gravity is above the center of buoyancy the equilibrium is unstable, and the body is liable to roll over in the water into such a position that its center of gravity is below its center of buoyancy. The same observations hold good as to bodies floating in air. A body which will float in unstable equilibrium in water would probably be in unstable equilibrium in mercury, the volume of mercury displaced having a much higher center of gravity than the displaced water, and therefore lifting the center of gravity of the floating body far above its center of buoyancy.

CENTER OF GRAVITY, or **CENTER OF INERTIA**, a point in a body, or in a system of bodies, which in modern works on mechanics is usually and preferably called the "center of mass." It is that point such that the vector sum (or integral) of the moments of the particles of the body with respect to it is zero. That is, if suspended by the center of mass or gravity the system will be in equilibrium in any position. See also **MASS**; **MECHANICS**.

CENTER OF OSCILLATION, or **CENTER OF PERCUSSION**, that point of a pendulum at which its entire mass may be considered as concentrated, for the purpose of determining its time of oscillation. The pendulum may be suspended by an axis parallel to its original axis and passing through the center of oscillation without altering its period.

CENTER OF POPULATION, the center of gravity of the population of a country,

Years Census	North latitude	West longitude
1790	39° 16.5'	76° 11.2'
1800	39° 16.1'	76° 56.5'
1810	39° 11.5'	77° 37.2'
1820	39° 5.7'	78° 33.0'
1830	38° 57.9'	79° 16.9'
1840	39° 2.0'	80° 18.0'
1850	38° 59.0'	81° 19.0'
1860	39° 0.4'	82° 48.8'
1870	39° 12.0'	83° 35.7'
1880	39° 4.1'	84° 30.7'
1890	39° 11.9'	85° 32.9'
1900	39° 9' 36"	85° 49' 54"
1910	39° 10' 12"	86° 32' 20"
1920	39° 10' 21"	86° 43' 15"
1930	39° 8' 45"	87° 8' 6"
1940	38° 56' 54"	87° 22' 35"

each individual being assumed to have the same weight.

The center of population in the United States has moved in a westward direction during the last 110 years along the parallel of 39° latitude, in 1930 reaching 2.9 miles northeast of Linton, Green County, Indiana. The foregoing table shows the centers by decades since 1790. See also **CENTROGRAPHY**.

CENTERBOARD, a contrivance used in a yacht or shallow, keelless or flat-bottomed vessel, to counteract the tendency to make leeway and to enable the craft to stand up under press of sail. It consists generally of a quadrangular wooden or iron plate which is bolted or hinged by its lower forward corner into a trunk or casing which fits, watertight, over a fore-and-aft slot in the vessel's bottom, about midway of her length and fitted so that it may be hauled inside the trunk. See also **YACHTS** AND **YACHTING**.

CENTERING, or **CENTRING**, the framing of timber by which the arch of a bridge or other arched structure is supported during its erection.

CENTERVILLE, Iowa, city in Appanoose County, altitude 1,013 feet, on the Rock Island and Burlington railroads, 70 miles south of Des Moines. Manufactures include bottling works, buttons, brick and tile, ice, steel culverts, castings, and soy-bean products. Centerville has a mayor and council government. Pop. (1940) 8,413; (1950) 7,625.

CENTIGRADE SCALE. See **THERMOMETER**.

CENTIMETER-GRAMME-SECOND or **CENTIMETER-GRAM-SECOND SYSTEM**. See **UNITS OF MEASUREMENT**.

CENTIPEDE, or **CENTIPED**, one of those myriapods (*Chilopoda*) with long, many-jointed, flattened bodies, each segment bearing only a single pair of appendages, which take the form of legs behind the head. The mouth-parts, besides a pair of jaws (mandibles), consist of two pairs of maxillae, those of each pair being fused together in the middle. The first pair of legs are fused at their base, and form the poison-fangs, the poison-gland being situated in the base, and the poison oozing out of an orifice at the end of the leg. The single oviduct and corresponding male duct open at the end of the body in the penultimate segment. The centipedes (*Scolopendra*) are mostly confined to the tropics, a small species extending as far north as North Carolina. Those of the West Indies and the tropics in general are eight to nine inches in length, one species, however, attaining the length of 18 inches. Their bite is dangerous, quite as much so as the sting of the scorpion. They are ferocious when attacked or seized, biting energetically. In the Northern States the centipedes are represented by the species of *Lithobius* (*L. americanus*), which are wrongly called "earwigs," and live under stones, under the bark of fallen trees, etc. They prey on insects and worms. They have been observed to attack earthworms, grappling with them for several hours and, after killing them, sucking their blood. Very long, slender forms are *Geophilus* and its allies. The body is

composed of from 19 to nearly 200 segments, each bearing a pair of legs. They are eyeless, and live buried in the sand, coming to the surface under stones.

The centipedes are hatched with numerous segments, and corresponding legs. Wood states that the female of a centipede (*Scolopocryptops scarpinosa*) guards her young by lying on her side, and then coiling her body, passes them along by a quick action of her feet, thus arranging them satisfactorily to herself. He also describes the manner of molting in this species.

The chilopods are more nearly related to the insects than are the millipedes. They are a less ancient group. No true *Chilopoda* are known to exist in rocks older than the Middle Tertiary period, species of *Cermatia*, *Scolopendra*, *Lithobius* and *Geophilus*, having been detected in amber and the gypsum beds of Aix, Provence, France, of Oligocene age. (See CHILOPODA.)

Consult Korschelt and Heider, *Lehrbuch der vergleichenden Entwicklungsgeschichte der wirbellosen Thiere* (Jena 1891); Sinclair, articles on Myriapods, *Cambridge Natural History*, vol. 5 (London 1895); Zittel, "Fossil Centipedes," *Textbook of Palaeontology* (ed. Eastman 1913); Brade-Birks, S. G., and H. K., "Luminous Chilopoda," in *Annals and Magazine of Natural History* (1920); Chamberlin, R. V., *New Genera and Species of American Lithobid Centipeds* (Logan, Utah 1941); id., *On Mexican Centipeds* (1943).

CENTLIVRE, sɛnt-liv'ɛr, **Susannah Freeman**, English actress and dramatist: b. Ireland about 1667; d. London, Dec. 1, 1723. When very young she married a nephew of Sir Stephen Fox. Becoming a widow within a year she took for a second husband an officer of the army of the name of Carrol, who was killed in a duel the second year of their wedlock. This event in her singular career reduced her to considerable distress, and led her to attempt dramatic composition. Her first production was a tragedy entitled *The Perjured Husband*, performed in 1700. This was followed by several comedies, chiefly translations from the French, which exhibited the vivacity that distinguishes her literary character, and met with some temporary success. She also tried the stage as an actress on the provincial boards, and by that means attracted the attention of her third and last husband, Joseph Centlivre, Queen Anne's head cook, whom she married in 1706. She still continued writing for the stage, and produced several more comedies. Some of these remain stock pieces, of which number are *The Busy Body*; *The Wonder* (1709); and *A Bold Stroke for a Wife! A Woman Keeps a Secret* (1714). They are diverting from the variety of incident and the liveliness of the characters, but want the accompaniments of adequate language and forcible delineation. They partook of the license of the age. Mrs. Centlivre enjoyed the friendship of Sir Richard Steele, George Farquhar, Nicholas Rowe and other wits of the day. Having, however, offended Alexander Pope, she obtained a place in the *Dunciad*, but is introduced by no means characteristically. An edition of her works with a biography appended appeared in 1761 and was reprinted in 1872.

CENTNER, a German weight, in common use on the continent of Europe, which is nearly the equivalent of the British hundredweight. It formerly varied in the different German states, but since the introduction of the metric system of weights and measures into the German Reich, Jan. 1, 1872, the value of the centner has been

fixed at 50 kilograms, or 100 German pounds equivalent to 110.23 pounds avoirdupois. In Austria it was equal to 110½ pounds, and in Sweden to 112.06 pounds.

CENTO, chɛn'tō, Italy, city 13 miles north of Bologna, on the eastern bank of the canal or Cento and near the river Reno. It is surrounded by a rampart and ditch and contains several churches, convents and a cathedral. The celebrated painter, Giovanni F. Barbieri, commonly called Guercino, was born here about 1590. A statue of him stands in front of the Palazzo Governativo. The gates of the ancient town have been preserved. It has a hemp and rice market. Pop. town 5,677; commune 22,371.

CENTO, sɛn'tō (Latin, "patchwork"), originally a cloak made of patches; hence, as Lessing observes, the dress of Harlequin is called in Apulcius *mimi centuculus*. The term has been transferred to such poems as have been formed out of verses taken from other poems. It was a particular art to combine passages of different authors on different subjects in this manner so as to form a regular whole. Thus there were in early times Virgilian centos (*centones virgiliani*) in which most of the verses were taken from Virgil; for instance, the *Cento Nuptialis* of Ausonius, and centos from the verses of Homer (*Homeric centones*). It was a favorite pastime in the Middle Ages.

Consult Delepierre, *Tableau de la littérature du cento* (London 1874-75).

CENTRAL AFRICA PROTECTORATE. See NYASALAND PROTECTORATE.

CENTRAL AMERICA, the geographical name applied to the narrow strip of land connecting North America and South America. Traditionally, Central America begins on the north at the boundary between Mexico, on the one hand, and Guatemala and British Honduras, on the other. The southern limit is the boundary between Panamá and Colombia (South America). The southward-tapering strip of land, thus delimited, extends roughly from northwest to southeast with an extremely irregular outline, and a width varying from 30 miles in some parts of Panamá to 350 miles near the Honduras-Nicaragua boundary. Central America includes an area of 228,578 square miles, and has an estimated population (1950) of 10,028,000.

Political Divisions.—The territory of Central America is divided among six republics and one British colony. From north to south, these political divisions, with area and population (1950 est.), are:

Political division	Area in sq. mi.	Population
British Honduras	8,688	70,000
Guatemala	42,044	3,717,000
Honduras	59,160	1,326,000
El Salvador	13,176	2,100,000
Nicaragua	57,143	1,173,000
Costa Rica	19,238	825,000
Panamá (including Canal Zone)	29,129	817,000
Central America	228,578	10,028,000

Terrain and Structure.—Central America is all too commonly considered to be a simple, continuous mountain range linking the mountains of

CENTRAL AMERICA

ADJACENT WATERS

Albuquerque (cays).....	G 4
Bajo Nuevo (isls.).....	M 3
Caribbean Sea.....	G 3
Great Corn (isl.).....	F 4
Guardian Bank.....	D 6
Little Corn (isl.).....	F 4
Pacific Ocean.....	C 5
Providencia, I. de.....	G 4
Quita Sueño Bank.....	G 3
Roncador Bank.....	H 4
Rosalind Bank.....	G 2
San Andres (isl.).....	G 4
Serrana Bank.....	G 3
Serranilla Bank.....	H 3
Swan Is.....	F 2

BRITISH HONDURAS

All Pines, 538.....	C 2
Ambergris Cay, 421.....	D 1
Belize (capital), 21,886.....	C 2
Belize (river).....	C 2
Bengue Viejo, 1,264.....	C 2
Cay Bokel.....	D 2
Cay Corker, 245.....	D 2
Cayo, 1,548.....	C 2
Cockscomb (mts.).....	C 2
Corozal, 2,190.....	C 1
Glovers Reef, 88.....	D 2
Half Moon Cay.....	D 2
Hill Bank.....	C 2
Honduras (gulf).....	C 2
Mauger Cay.....	D 2
Monkey River (town), 421.....	C 2
New (river).....	C 2
Orange Walk, 1,395.....	C 1
Punta Gorda, 1,375.....	C 2
Rio Hondo (river).....	C 1
St. Georges Cay.....	D 2
San José.....	C 2
San Pedro, 36.....	D 2
Stann Creek, 3,414.....	C 2
Turneffe (isl.).....	D 2

COSTA RICA

Alajuela, 13,903.....	E 6
Atenas, 638.....	E 6
Atlanta.....	F 6
Bagaces, 706.....	E 5
Beverly.....	F 6
Blanca (point).....	F 5
Blanco (cape).....	E 6
Blanco (mt.).....	F 6
Boruca.....	F 6
Buenos Aires.....	F 6
Burica (point).....	F 6
Cañuita (point).....	F 6
Caño (isl.).....	F 6
Carmon, 8,891.....	F 5
Carreta (point).....	F 6
Cartago, 12,933.....	F 6
Chirripo Grande (mt.).....	F 6
Chomes.....	E 5
Coronada (bay).....	F 6
Culapa Miravalles (volcano).....	E 5
Dulce (gulf).....	F 6
El Salvador.....	F 5
Esparta, 1,925.....	E 5
Filadelfia, 884.....	E 5
Gongora (mt.).....	E 5
Grecia, 2,824.....	E 5

Guacimo.....	F 5
Guapiles, 1,917.....	F 5
Guionos (point).....	E 6
Heredia, 11,967.....	E 5
Irazu (mt.).....	F 6
Judas (point).....	E 6
Las Canas.....	E 5
Las Juntas, 808.....	E 5
Liberia, 3,390.....	E 5
Limon, 11,310.....	F 6
Llerena (point).....	F 6
Matapalo (cape).....	F 6
Miramar, 899.....	E 5
Murcielagos (gulf).....	D 5
Nicoya, 1,825.....	E 5
Nicoya (gulf).....	E 6
Nicoya (peninsula).....	E 6
Orotina, 1,286.....	E 6
Palmares, 671.....	F 6
Paquera.....	E 6
Paraiso, 1,759.....	F 6
Pejivalle.....	F 6
Platanilla.....	F 6
Playa Bonita.....	E 6
Puntarenas, 13,272.....	E 6
Salinas (bay).....	D 5
San Ignacio de Acosta, 293.....	E 6
San José (capital), 109,893.....	F 5
San Juan (river).....	E 5
San Marcos, 202.....	E 6
San Ramón, 3,747.....	E 5
Santa Cruz, 1,986.....	E 5
Santa Elena (cape).....	D 5
Santa Rosa.....	E 5
Santo Domingo, 2,165.....	F 6
Subibe.....	F 6
Siquirres, 326.....	F 5
Suretha.....	F 6
Talamanca (mts.).....	F 6
Turrialba, 5,449.....	F 6
Velas (cape).....	D 5
Vesta.....	F 6
Villa Quesada, 1,892.....	E 5

GUATEMALA

Amatitlán, 6,683.....	B 3
Antigua, 10,691.....	B 3
Asunción Mita, 2,791.....	C 3
Atitlán (lake).....	B 3
Atitlán (volcano).....	B 3
Azul (river).....	C 2
Batcab.....	B 2
Cahabón, 1,552.....	C 3
Chahal, 329.....	C 3
Chajul, 3,391.....	B 3
Champerico, 982.....	A 3
Chimaltenango, 6,059.....	B 3
Chinaja.....	B 2
Chiquimula, 8,848.....	C 3
Chisec, 306.....	B 3
Chixoy (river).....	B 2
Cotepeque, 6,714.....	B 3
Cobán, 6,854.....	B 3
Cuajiniquilapa.....	B 3
Cubulco, 1,166.....	B 3
Cuilco, 564.....	B 3
Dolores, 512.....	C 2
El Cambio.....	C 2
El Porvenir.....	B 2
Escuintla, 9,822.....	B 3
Florida, 1,579.....	C 2
Gracias a Dios.....	B 2
Guslan, 2,933.....	C 3
Guatemala (capital), 283,100.....	B 3

Guja (lake).....	C 3
Honduras (gulf).....	D 2
Huehuetenango, 5,740.....	B 3
Iapala, 2,003.....	C 3
Izabal.....	C 3
Izabal (lake).....	C 3
Iztapa, 427.....	B 4
Jacaltenango, 3,298.....	B 3
Jalapa, 6,605.....	B 3
Jutiapa, 5,141.....	B 3
La Gomera, 392.....	B 3
La Libertad, 632.....	B 2
Livingston, 2,802.....	C 3
Los Amates, 628.....	C 3
Masagua, 474.....	B 3
Mazatenango, 10,735.....	B 3
Minas (mts.).....	C 3
Momostenango, 7,956.....	B 3
Morales, 1,031.....	C 3
Morazan.....	B 3
Motagua (river).....	C 3
Nejapa.....	B 3
Ocos, 340.....	A 3
Panzos, 573.....	C 3
Pasion (river).....	B 2
Peten Itza (lake).....	B 2
Progreso, 2,461.....	B 2
Puerto Barrios, 15,659.....	C 3
Quezaltenango, 27,782.....	B 3
Quezaltepeque, 1,512.....	C 3
Rabinal, 2,587.....	B 3
Retalhuleu, 7,677.....	B 3
Rio Hondo, 814.....	C 3
Sacapulas, 1,000.....	B 3
Saizabaja, 527.....	B 3
Salama, 2,648.....	B 3
San Andres, 999.....	B 2
San Felipe, 2,378.....	B 3
San José, 467.....	B 4
San Juan de Dios.....	B 2
San Lorenzo, 697.....	C 2
San Luis, 563.....	C 2
San Luis Jilotepeque, 4,098.....	C 3
San Marcos, 4,700.....	B 3
San Martin, 2,132.....	B 3
San Mateo, 848.....	B 3
San Miguel.....	C 2
San Pedro Martir (river).....	B 2
Santa Ana, 189.....	C 2
Sta. Ana Mixtan.....	B 4
Sta. Cruz Quiche, 4,200.....	B 3
Santa Rosa, 3,405.....	B 3
Sarstun (river).....	C 3
Sipacate.....	B 4
Solola, 3,308.....	B 3
Tacana, 857.....	A 3
Tajumulco (volcano).....	B 3
Tecpan, 3,113.....	B 3
Tejutila, 801.....	B 3
Toloncapán, 9,492.....	B 3
Tres Puntas (cape).....	C 3
Usumacinta (river).....	B 2
Yaloch.....	C 2
Zacapa, 8,282.....	C 3

EL SALVADOR (See Salvador, El) HONDURAS

Aguan (river).....	D 3
Alargate Reef.....	F 3
Amapala, 2,934.....	D 4
Balfate, 526.....	D 3
Belén, 408.....	C 3
Bonacca (isl.).....	E 2

Brewers.....	E 3
Brus (lagoon).....	E 3
Camarón (cape).....	E 3
Caratasca (lagoon).....	F 3
Caratasca Cays.....	F 2
Catacamas, 1,040.....	E 3
Cay Gorda.....	F 3
Cedros, 1,313.....	D 3
Chichicaste.....	D 3
Choluteca, 7,075.....	D 4
Choluteca (river).....	D 4
Colón (mts.).....	E 3
Colorado.....	D 3
Comayagua, 5,192.....	D 3
Comayaguela.....	D 3
Concepción, 522.....	D 4
Concordia, 202.....	D 3
Corquin, 2,507.....	C 3
Danli, 4,207.....	D 3
Donel.....	E 3
El Dulce Nombre, 90.....	E 3
El Paraíso, 591.....	C 3
El Paraíso, 2,805.....	D 4
El Porvenir, 1,020.....	D 3
El Progreso, 9,150.....	D 3
El Triunfo, 1,160.....	D 4
Esperanza (mts.).....	E 3
Falso (cape).....	F 3
Fonseca (gulf).....	D 4
Goscorán, 1,680.....	D 4
Gorda Bank.....	F 3
Gracias, 1,589.....	C 3
Guainaca, 879.....	D 3
Guarita, 1,120.....	C 3
Guayape, 639.....	D 3
Half Moon (reefs).....	F 3
Honduras (cape).....	E 3
Honduras (gulf).....	D 2
Iriona, 2,780.....	E 3
Islas de la Bahía.....	D 2
Jacaleapa, 793.....	D 3
Jesus de Otoro, 1,947.....	C 3
Jutiapa, 712.....	D 3
Juticalpa, 1,477.....	D 3
La Ceiba, 16,645.....	D 3
La Concepción.....	E 3
La Esperanza, 1,959.....	C 3
La Guata, 393.....	D 3
La Paz, 3,877.....	D 3
La Protección.....	D 3
Lauterique, 250.....	D 4
Limón, 475.....	E 3
Marcala, 1,921.....	C 3
Manto, 576.....	D 3
Melcher.....	D 3
Merendón, 554.....	C 3
Morazan, 1,127.....	D 3
Moroceli, 884.....	D 3
Nacaome, 3,429.....	D 4
Namasique, 683.....	D 4
Naranjito, 2,736.....	C 3
Nueva Armenia, 525.....	D 4
Ocoatepeque, 4,170.....	C 3
Olancho, 3,256.....	D 3
Omoa, 466.....	C 3
Patuca.....	E 3
Patuca (point).....	E 3
Patuca (river).....	E 3
Paulaya (river).....	E 3
Pespire, 1,288.....	D 4
Pigeon Cays.....	F 3
Pija (mts.).....	D 3
Puerto Castilla.....	D 3
Puerto Cortés, 12,228.....	D 3
Roatán, 870.....	D 2
Roatán (isl.).....	D 2
Sabana Grande, 1,580.....	D 4

10°F., and frequently less than 5°F. At Greytown (San Juan del Norte), on the coast in southern Nicaragua, for example, a short record shows December and January to average 77.5°F., whereas April and May average 80.8°F. There is much greater difference between day and night, often as much as 15°F. Yet, seldom do temperatures reach the high 90's. Accompanying the uniformly high temperatures are large amounts of rain with no pronounced period of dryness. The coast is exposed throughout the year to the trade winds from off the warm ocean to the east and, thus, along most of its length, the Caribbean coast receives over 80 inches of rainfall during the year. The largest amount falls on the lowland along the border between Nicaragua and Costa Rica. The short Greytown record shows an average of 259 inches per year, with March the driest month (6.5 inches). At all times, relative humidity is high; days without some rain are infrequent.

Most of the Pacific coastal zone has like temperatures, but rainfall differs markedly in amount and in distribution through the year. The amount is seldom in excess of 80 inches per year, and is much more commonly between 50 and 60 inches. Furthermore, the rainfall is distinctly seasonal. Slight amounts fall from October through March, when the winds are dominantly offshore. The greater part of the year's total is concentrated in the period from March through September, when southerly and southwesterly winds from off the warm Pacific blow onshore.

Throughout the highlands, there is less climatic uniformity. Temperatures are generally lower with increased elevation, and there is a tendency over the greater part of the highlands toward seasonal distribution of rain, similar to that along the Pacific coast. Where the slopes are oriented so as to intercept the moist winds from off the Caribbean, however, amounts are large, and distribution through the year is much more even. Guatemala City, at an elevation of 4,900 feet, offers a fairly representative sample for the highland as a whole. There, the warmest month, May, averages 69°F., and the coolest month, December, averages 61°F.; the rainfall averages 52 inches per year; and each month, from November through March, has less than one inch of rain.

The differences induced by altitude are sufficiently well marked so that there can be recognized rather clearly defined zones at different altitudes. These are known, in order, from lowest to highest, as the *tierra caliente*, the *tierra templada*, and the *tierra fría*. The climatic differences are reflected particularly in changes in natural vegetation and crops. The limits of each zone are generally higher on the Caribbean than on the Pacific side of the isthmus, primarily because of the greater rainfall on that side. The height limits, likewise, decrease northwards. In Costa Rica, L. Waibel states the height limits to be as follows: *tierra caliente*—sea level to 2,100 feet, on the Caribbean side, and to 1,475 feet, on the Pacific side; *tierra templada*—2,100 to 5,900 feet, on the Caribbean side, and 1,475 to 4,900 feet, on the Pacific side; and *tierra fría*—above 5,900 feet, on the Caribbean side, and above 4,900 feet, on the Pacific side.

Hydrography.—There are no long rivers in Central America. Likewise, none of the streams is navigable for commercial vessels. The divide between the Caribbean and the Pacific drainages

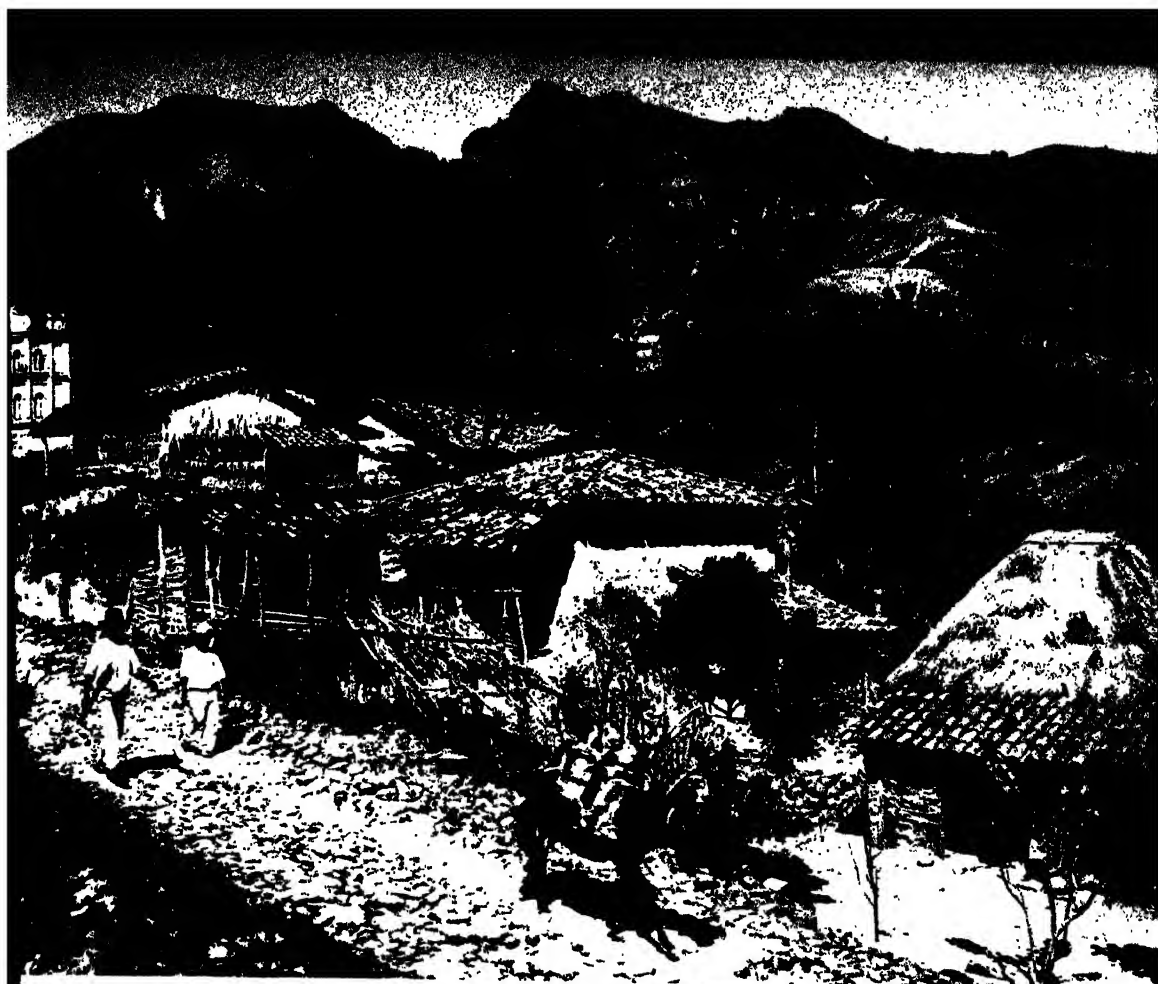
lies everywhere close to the Pacific coast. Streams flowing into the Caribbean vary less in volume than those flowing into the Pacific because of the large amount of rainfall, and its more regular distribution through the year, throughout their basins. Destructive local floods are common along the rivers flowing toward the Pacific during the rainy season; these same streams are practically without water during the dry season. Only a few lakes deserve mention. In one of the intermont basins of highland Guatemala lies the touristically famous Lake Atitlán, and in the swampy lowland of eastern Guatemala lies Lake Izabel. Lakes Managua and Nicaragua complete the list. South of the Nicaraguan Lowland lakes are conspicuously absent.

Natural Vegetation.—The hot, wet lowlands of Central America bear a dense cover of tropical forest. Broadleaf evergreen trees of many species, including cabinet woods like mahogany and rosewood, spread over much of the *tierra caliente*, particularly along the wetter Caribbean coast. Where the rainfall is less, or where there is a pronounced dry period during the year, the forest is lighter, and is deciduous. In a few relatively dry areas, as along the Pacific coast of Guatemala, or in the eastern lowland of El Salvador, the forest gives way to tropical grass (savanna). Increased elevation, with the attendant lowering of temperatures, brings about a change in the forest type. Trees like the oak replace the tropical species. And, above them, in the highlands of Guatemala, Honduras, and northern Nicaragua, there are forests of pine. At the highest elevations, usually above 10,000 feet, mountain grass replaces the forest.

Much of the original forest in the highlands has been removed, largely to make way for agriculture. Similarly, in the lowlands, where plantations have developed, as on the coast of eastern Guatemala and northern Honduras, the original cover has been largely destroyed.

Mineral Resources.—Central America is significantly poor in most mineral resources. Silver has been mined at Huehuetenango, in the Guatemalan highland, since the latter part of the sixteenth century. Small amounts of gold, silver, mercury, and lead are produced in northwestern El Salvador. Silver and gold, in small amount are produced in Honduras, particularly near Tegucigalpa, and along the Nicaraguan border. Gold is dredged from several Nicaraguan rivers. In no instance is the amount significant in terms of total world production.

Population.—Central America's ten million people are racially diverse. Further, the proportion of each element in the population varies from country to country. For the whole area, the Indian and mestizo (mixed Indian and European) elements are both far superior in numbers to any of the other groups. People of unmixed European stock form the third most numerous group, and Negroes, together with Negro mixtures, the smallest. Forty-five per cent of the total population is mestizo; 41 per cent, Indian; 10 per cent European; and 4 per cent, Negro. These proportions do not hold, however, when each country is considered separately. The population of Guatemala is dominantly (67 per cent) unmixed Indian; that of Nicaragua is dominantly (77 per cent) mestizo; and in Costa Rica, the unmixed European element is the largest (48 per cent). The largest Negro element (48 per cent) is in British Honduras. This racial diversity is in part



CENTRAL AMERICA

Top: Panchimalco, a Pipil Indian town in the coastal mountains of El Salvador, just south of the capital. The baroque church is noted for its exterior sculptures, fine wood carving inside, and a bell presented by the Emperor Charles V. Right: Young woman of the San Blas region of northeastern Panama. Her jewelry includes a necklace of coins from Panama, the United States, and other countries.

Bottom left: Indian woman washing clothes in a stream near Quezaltenango in western Guatemala.

Photographs from Ewing Galloway





Top: Swimming pool at Atecozol National Park in western El Salvador. Izalco Volcano, whose light at night is visible from the Pacific Ocean, steams in the background.



Left: Gold mine near Siuna in northeastern Nicaragua.

Bottom left: Pottery vendor on a street corner in Tegucigalpa, the Honduran capital.

Bottom right: Part of the family and their hut in the interior of Panama.

Photographs from Ewing Galloway



a reflection of the early population distribution. The Old Maya Empire developed in lowland Guatemala and adjacent Mexico. It was there that the largest Indian population existed at the time of European conquest. In contrast, Negroes were the last group to be introduced. They were brought to the coastal lowlands of British Honduras, Honduras, and Nicaragua, primarily to supply plantation labor requirements. The main center of unmixed Indian population is the Guatemalan highland; most of the population there is still of Mayan origin. In eastern Honduras, and in eastern Nicaragua, back from the coast, the population is also unmixed Indian, but of other stocks than the Mayan. A third Indian concentration is found in eastern Panamá. Negroes and Negro admixtures are still most numerous in the coastal areas aforementioned. The only center of unmixed European blood is the San José section of highland Costa Rica. Elsewhere, throughout Central America, mestizos form the bulk of the population.

The distribution of people throughout Central America is very uneven. Within each country, there are both densely settled and nearly empty lands. Likewise, each country has distinct settlement nuclei. The population of Guatemala, for example, is concentrated in the southern highland third of the country, while the northern lowland half is almost devoid of population. The highland core of El Salvador is densely peopled in contrast to the nearly empty lowlands. Within Honduras, there is a dense fringe along the northern coastal lowland, and there are dense clusters in the intermont basins along the El Salvador boundary. In Nicaragua, the concentrations are in the western part of the Nicaraguan Lowland, and along parts of the Caribbean coast. Costa Rica's population is remarkably tightly packed in the San José section. In Panamá, sections of both the Pacific and Caribbean coastal lowlands and the Canal Zone are densely peopled, while most of the mountainous interior is empty.

Economic Life.—Agriculture dominates the life of the greater part of the population of Central America. It ranges in type from the primitive migratory, or shifting, cultivation of cleared forest patches, to highly specialized commercial plantation agriculture. Throughout the whole area, three crops stand out as the keys to the agricultural scene: maize, coffee, and bananas. The subsistence farming of most of the population rests upon the cultivation of maize. Combined with this crop are a variety of secondaries like rice, beans, and potatoes. Cotton, henequen, sugar cane, and tobacco are frequently grown, largely for local use, but occasionally in amounts of a commercial size. Cacao has its place as well.

On the commercial scale, coffee and bananas outrank all other crops. Coffee is the highland crop, and bananas, the lowland crop. For the most part, coffee occupies hill land, often so steeply sloping as to be unsuited for other than tree crops. Both garden and plantation forms exist, and the cultivation is in the hands of the native peoples, for the greater part. In the lowlands, particularly the Caribbean lowlands of northern Honduras, eastern Guatemala, and Costa Rica, foreign controlled banana plantations have expanded to include large acreages of formerly wet jungle land. Most of these plantations are under the control of the United Fruit Company.

The list of other tropical products includes indigo, abaca, palm oil, and coconuts. All are

of local rather than of area-wide significance.

In addition to agriculture, there is appreciable attention, particularly in British Honduras and in Guatemala, to forest products, from cabinet woods to chicle. Likewise, mining makes a real contribution, especially in Nicaragua. The grazing of cattle, in the savannas of eastern El Salvador and in the mountain grasslands of Honduras, adds slightly to the total economy.

In Panamá, the dominant role of agriculture is overshadowed by the strong influence of the Canal Zone. In this 10-mile-wide strip of land and water, over which the United States has essentially complete control, a large portion of the total Panamanian national income is received by a relatively small part of the total Panamanian population for services related to the presence of the canal. This situation is reflected in a per capita income for Panamá higher than that in any other Central American state.

So far as foreign trade is concerned, the role of the United States is the dominating one. Between 75 and 90 per cent of all exports, from each of the republics, are destined for the United States market, while 65 to 75 per cent of all imports come from the United States. The small trade of British Honduras is more closely linked with that of other British possessions.

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HENRY M. KENDALL,
Professor of Geography, Miami University;
Coauthor of "Introduction to Geography."

CENTRAL AMERICA, Diplomatic Relations with.—The earlier general interest of the United States in Latin America was first attracted to a larger consideration of the problems relating to Central America under Monroe's administration, which in 1818 had an opportunity to consider suggestions for establishing the southern limit of the United States at the Isthmus of Panama, in 1819 completed the establishment of the United States as a Gulf power by the acquisition of Florida, in 1822 recognized the extinguishment of direct Spanish interests in Mexico, and in 1823 received from Salvador diplomatic overtures for annexation or a protectorate—overtures which were later withdrawn by the disappearance of the danger of forced annexation to Mexico.

In 1823, with consent of Mexico the five Central American states were united into a national federation which subsequently adopted a constitution on the model of that of the United States and borrowed the code of Louisiana.

Central American commissioners presented their credentials at Washington Sept. 10, 1823. In 1824, Secretary Adams instructed Thomas N. Mann to visit Guatemala to obtain statistics and political information; and in 1825 the American government recognized the Federation of Central America, which in the same year was also recognized by Great Britain and the Netherlands. The first American diplomatic agent to the Federation, John Williams, was commissioned on Dec. 29, 1825; and the last American representative to the Federation, appointed in 1841, left his post in March 1842. The last Federation

representative at Washington took his leave March 16, 1828.

On Dec. 5, 1825, the United States negotiated with the Federation a treaty of commerce which expired by its own limitations in 1837 and was never renewed. In April 1825, the American government received from Canaz, the representative of the Federation, a proposal of co-operation in promoting the opening of a canal through Nicaragua, and, in 1826, through the influence of Mr. Williams, the Central American government contracted with A. H. Palmer of New York for the construction of the canal; but failure of plans caused Central America to open negotiations with a Holland company, whose plans failed by the political disturbances in connection with the separation of Belgium from Holland in 1830.

As a result of rebellions, the Federation was partially ended by 1833. It was practically dissolved by 1839 by the legislative decree of 1838 granting each member of the Union the privilege of unrestrained action in the most important matters, and completely dissolved by 1847.

After the complete dissolution of the Federation, American diplomatic representatives to the separate republics were first sent to Guatemala in 1848, to Salvador in 1849, to Nicaragua in 1851, to Costa Rica in 1852 and to Honduras in 1853. Diplomatic representatives of the separate Central American states were received at Washington from Nicaragua in 1849, from Costa Rica in 1851, from Guatemala in 1851, from Salvador in 1853 and from Honduras in 1854. A commercial treaty was negotiated with Costa Rica in 1851. A similar treaty, negotiated with Nicaragua in 1849 and at subsequent periods, did not become operative.

Active American diplomacy affecting Central America really began with the military occupation of California and the resulting Colombia treaty of 1846 which was ratified in June 1848. The motive which attracted the American government to exercise a larger influence over the region was associated with the problem of the establishment and proper control of a new route to California. It was also connected with the development of canal plans by Louis Napoleon between 1844 and 1848, and consequent competitive English operations and plans in Central America, especially the occupation of the Nicaraguan port of San Juan (Greytown) which precipitated the intervention of American diplomacy and the negotiation of the famous Clayton-Bulwer Treaty (q.v.) of 1850 which guaranteed the integrity and independence of Central American territory and prepared the way for the extinguishment of any British claim of sovereignty or protectorate over the Mosquito Indians along the coast of Nicaragua—a claim which was finally terminated by the English treaty negotiated by Wyke with Nicaragua, in January 1860. On questions connected with these negotiations Central America requested and welcomed the support of the United States.

Boundary questions between Central American states furnished an opportunity for England to assert her earlier territorial claim. In 1852 Webster, acting under friendly mediation of the American government, submitted propositions for adjustment of such questions between Costa Rica and Nicaragua, but they were rejected by Nicaragua. In 1853, William Marcy, anxious to prevent European intermeddling in Central American affairs (and especially English encroachments in

Honduras), encouraged the reestablishment of the Central Federation, but he was not ready to pledge the American government to expel the British from the Bay Islands. After 1853, American diplomatic relations in Central America were affected by the constant apprehension of European influence inimical to American interests, and by a series of irritating events including the bombardment and burning of Greytown by Americans in 1854 as a punishment for an alleged insult to the American Minister to Nicaragua.

Relations were complicated by Walker's bold designs in connection with the political factions in Nicaragua, culminating in his conquest of Nicaragua and his election to the presidency of the country. By his expeditions, and by the filibuster diplomacy with which he vainly sought to gain recognition at Washington, he caused Nicaragua to present to the American government a series of claims for damages and created an ill feeling of all the Latin American representatives which culminated in the draft of the proposed treaty of alliance against the supposed designs of the United States.

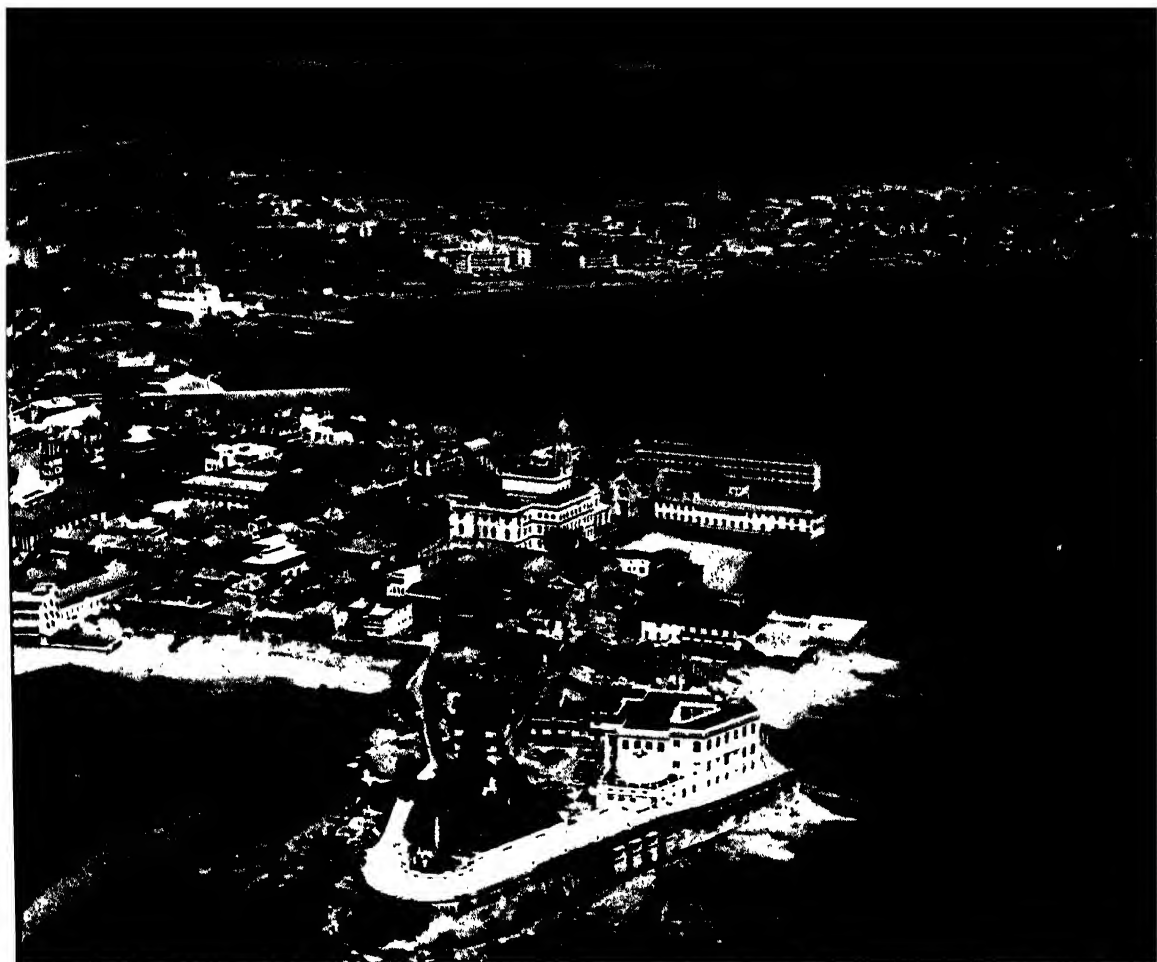
The most important result of the Walker episode was the closure of the transit, causing a diversion of traffic which perhaps changed the destiny of Nicaragua.

In this period, by 1856, the American government adopted a more aggressive American policy in regard to control of transit and canal routes.

During the Civil War, the Central American people, seeing that the causes which produced filibustering, were passing away by the results of Union victories, and fearing the designs of all Europe (and especially of France) against American states, became more friendly to the government at Washington and anxiously hoped for the restoration of the Union. Soon after the fall of Vicksburg and the failure of Lee at Gettysburg, some advocated annexation to the United States. Others relying on the American government as natural protector of American republics requested alliance or aid. To them W. H. Seward replied that the most effective aid to American republics was the moral influence resulting from the integrity of the American Union and the stability of republican institutions.

The considerate policy of Secretary Seward during the Civil War period in forbearing to press claims of American citizens against the government of Nicaragua—claims which had long been a source of diplomatic irritation—unfortunately caused Nicaragua to regard the claims as abandoned and to refuse to negotiate a claims convention in 1871, although she agreed to a treaty of amity, commerce and navigation in 1867. The claims long remained a source of diplomatic discussion at intervals and were never settled.

Until the beginning of the 20th century the chief interest and attention of the United States in Central America, aside from the maintenance of the Monroe Doctrine, were centered in the possibility of constructing a transisthmian canal across Nicaragua. With the idea that the Nicaraguan route was more practical than the Panama route, an American canal company was organized in 1889—nominally to build a canal across Nicaragua, but really to induce the American government to take the responsibility in the enterprise. Until 1903, a violent controversy



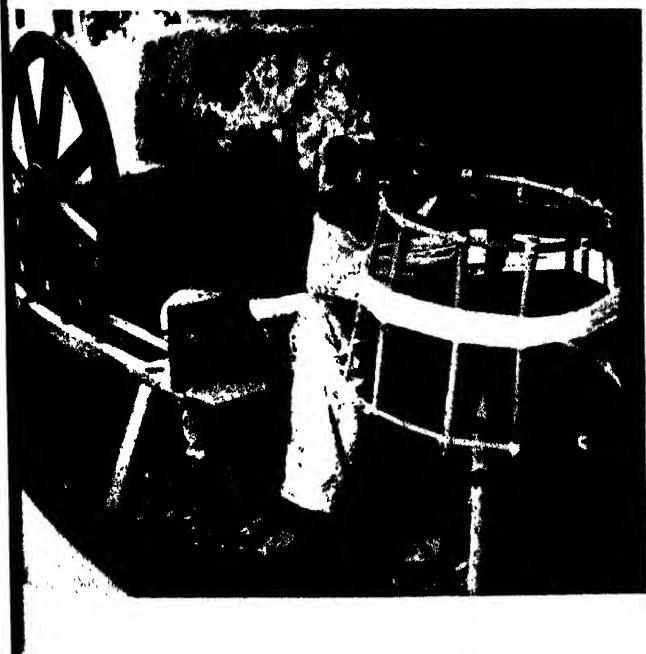
CENTRAL AMERICA

Top: Panama City. At bottom are remnants of the old fortifications. The white building at center, in front of the tower of San Francisco Church, is the Panamanian capitol.

Right: Barefoot marimba carrier on the road near Sololá in southwestern Guatemala.

Bottom left: Winding thread at an inland town in El Salvador.

Photographs from Ewing Galloway





Top: Crossing Lake Atitlán in Guatemala. San Pedro Volcano, in the background, is one of several on the lake shore.



Left: Grinding sugarcane near San Vicente in central El Salvador

Bottom left: Boy on a sunny street corner in Guatemala.

Bottom right: A belle of San José, Costa Rica, who was chosen Coffee Queen.

Photographs from Ewing Galloway



ensued between the advocates of the two routes. With the idea of constructing a canal via the Nicaragua route the American government negotiated for the withdrawal of the Clayton-Bulwer Treaty which was finally terminated by the Hay-Pauncefote Treaty of December 1901. Soon thereafter, however, a decision was made in favor of the Panama route, disappointing the hopes of Nicaragua.

By 1917 the United States dominated the Central American market and invested in Central America more capital than any other country, and was thus more closely related to the country by economic bonds.

The American government, with a policy of forbearance and national unselfishness, too long allowed Central America to suffer from divisions, irresponsible leadership, revolution and bankruptcy. True, it sometimes used its good offices to prevent interstate conflicts, illustrated in 1888 by President Cleveland's arbitration of a long pending boundary dispute between Costa Rica and Nicaragua. With the hope of reducing sources of conflict it also urged a closer union and cooperation, recommending a return to the earlier policy of federation. In 1874 it began a series of friendly efforts to encourage the establishment of a strong and settled union, but practically abandoned its diplomatic efforts in that direction after the *pourparlers* of Blaine in 1881.

In 1896, the last attempt to restore the early federal union was made by the Presidents of Honduras, Nicaragua and Salvador, who (in accord with a treaty of 1895) formed, for the exercise of their external sovereignty, a single loose political organization with the title "Greater Republic of Central America" which was promptly recognized by the American government by the reception of a minister, but with the distinct understanding that the responsibility of each of the separate republics toward the United States remained wholly unaffected. Again the hope of the formation of a permanent federation was disappointed. In 1898, as a result of revolutionary movements—and especially a separatist movement in Salvador—the provisional executive council of the Greater Republic announced the dissolution of the union by mutual consent.

In 1906 President Theodore Roosevelt with the cooperation of President José Díaz, in order to terminate a war, acted as mediator in a dispute of Guatemala with Salvador and Honduras. This was in accord with the treaty of peace which received the assent of all the five republics except that of President Zelaya of Nicaragua, and directly recognized the obligation of the United States to mediate and intervene in Central American affairs. In February 1907 the American government failed in a friendly mediation to prevent Zelaya from making war against Honduras, but was able to prevent the spread of the conflict to Salvador and Guatemala. In August 1907, by strenuous diplomatic representations, it averted war between Nicaragua and Salvador.

At Washington, in 1907, through negotiations encouraged and stimulated by the United States on the initiative of President Roosevelt, the diplomatic representatives of the five separate republics held a Central American Peace Conference to find a basis of agreement on political, commercial and financial relations. The chief results were a series of palliative measures: the establishment of a Central American International Bureau as a

bureau of information (a miniature of the Pan American Union); the foundation of a Central American Court of Justice (five members) in Costa Rica, for the arbitration of questions of an international character affecting the relations of the five republics; and a provision for later Central American annual conferences to discuss political and economic questions of community interest.

The American government, after the derision which greeted the first decision of the new Central American Court, concluded that a court without means of enforcing its decisions was of no value—and reluctantly, but logically, concluded that American intervention was necessary to prevent depredations by the Zelaya government in Central America. In 1909, after the execution of two Americans in Nicaragua, it intervened directly, compelled Zelaya to flee and entered into a treaty agreement (negotiated by Secretary Knox) to act as a receiver for Nicaragua and to aid the new government in the rehabilitation of its finances. In the summer of 1912 it landed troops at the request of the Nicaraguan government to protect American lives and property and preserve free communication with the legation, and operated the national railway under the protection of American soldiers. It also negotiated a treaty, later approved by the Wilson administration, securing for its services in rehabilitating the finances sole rights to the construction of a canal across Nicaragua and to a coaling station in the Gulf of Fonseca. In August 1914 the Nicaraguan government was kept in power only by the presence of American troops landed at Bluefields.

The treaty, finally ratified by the American Senate in February 1916, providing substantial aid for the support of legally constituted good government in Nicaragua, was opposed by Costa Rica, who complained that it violated her rights. It was also opposed elsewhere in Central America on the ground that it would prove an obstacle to Central American union. The governments of Salvador and Honduras joined in the protest. Costa Rica brought suit against Nicaragua in the Central American Court of Justice at Cartago, Costa Rica. The court (in 1916) decided that Nicaragua acted illegally in selling canal rights without consulting Costa Rica, and in threatening the neutrality of Honduras by permitting a United States naval base to be established on the Gulf of Fonseca; but Nicaragua refused to be bound by the decision.

In 1922 new steps were taken to improve the situation in Central America where an arrangement for a federation had been repudiated by Guatemala in December 1921 and had disintegrated on Feb. 2, 1922, before the date selected for the birth of the proposed union. In August 1922, in the face of political troubles which threatened war, the United States obtained a meeting of the presidents of Nicaragua, Salvador, and Honduras on board the United States ship *Tacoma* in the Gulf of Fonseca to concert measures for establishment of more peaceful relations in Central America. These three executives agreed upon a renewal of the treaty of peace of 1907 with Costa Rica and Guatemala—a treaty which was later (in 1923) definitely recognized as still in force. As a result of this agreement and in acceptance of an invitation of the American government, the governments of the five Central American republics sent representatives

to Washington for a December conference on Central American affairs, with a view to negotiation of new treaties to insure permanent peace and cooperation among the Central American states. This conference agreed upon Pan American solidarity, but split on the issue of federation which was proposed by Honduras. It adjourned Feb. 7, 1923, after agreeing upon a treaty of peace and amity, 11 conventions, and three protocols. It accepted the jurisdiction of the new Central American Court over all controversies not settled by diplomacy arbitration, or some other tribunal. Later, Guatemala and Honduras agreed to submit their boundary dispute to President Harding for arbitration, and Costa Rica obtained from the United States government an agreement to consult Costa Rica directly concerning the latter's interest involved in the possible construction of the proposed Nicaragua canal by the United States.

Over a decade later the United States government, while negotiating reciprocal trade agreements (one of which was signed with Costa Rica on Nov. 28, 1936), showed a live interest in several Central American boundary disputes: one between Guatemala and Salvador which was settled on Jan. 24, 1934; one between Guatemala and Honduras which was settled in 1935; one between Costa Rica and Nicaragua which was finally settled in 1941; an old one between Nicaragua and Honduras which became heated in 1937 and was still pending in 1941; one between Costa Rica and Panama, adjustment of which was provided by a treaty of Sept. 26, 1938, but was delayed by strong protests resulting in withdrawal of the treaty from the Costa Rican Congress; and the Guatemalan claim on British Honduras which in 1941 was pending settlement, awaiting the outcome of the European situation.

Meantime, in 1938, 1940, and 1941, before American entrance into World War II, United States diplomacy was responsible for reduction of trade barriers between the Central American states and between the latter and the United States. It cooperated in plans for improved communication. In 1940 and 1941 United States loans to Nicaragua and Costa Rica aided in the further construction of the Pan American Highway across the Central American republics.

After entrance into the war against the Axis powers, the United States government increased its cooperation and influence in Central America. In November 1941, by an agreement of the preceding July, it cooperated with Costa Rica by furnishing a United States Army mission for training of the increased Costa Rican armed force which was needed in connection with an anti-Axis policy. In 1942, following the United Nations joint declaration of January 1, it also obtained from Costa Rica permission for United States military and air forces to use Costa Rican bases in the antisubmarine campaign and signed with it a lend-lease agreement. The wide extent of Central American collaboration and increasingly close relations with the United States in 1942, following the declaration of war against the Axis powers by the Central American states in December 1941, is illustrated by Guatemalan deportation of Germans to the United States for internment, the United States patrol of its Caribbean and Pacific coasts, and the union of Guatemalan forces with those of the United States "for hemisphere solidarity." All cooperated in the financial and economic policies and plans adopted

by the Inter-American conference for curbing Axis espionage and propaganda.

In 1942-1943 the United States government obtained agreements under which the United States Rubber Reserve Company contracted with Guatemala, Costa Rica, and Salvador to purchase all the surplus rubber of those republics for a period of five years. It also cooperated with the United States Fruit Company to shift its interest from banana contracts to a substitute program for developing the production of rubber, Manila hemp, quinine, and other articles needed in the war period. Meantime, it increased its interest in plans for improved communication across Central America. In July 1942 it announced the conclusion of arrangements with Guatemala and other republics for immediate linking of the finished segments of the Inter-American Highway between the Mexican-Guatemalan border and Panama City. In June 1943 it arranged to build across Costa Rica from Nicaragua to the Panama frontier another road for use in transportation of food supplies to the Canal Zone—planned as a strategic highway in case the Panama Canal should be blocked by war operations. See also CENTRAL AMERICA; LATIN AMERICA—World Affairs.

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JAMES M. CALLAHAN,
Professor of History and Political Science, West Virginia University.

CENTRAL CITY, city, Colorado, and seat of Gilpin County, at an altitude of 8,513 feet, a few miles from the Continental Divide, 26 miles west of Denver. It lies in a gold-mining district with mines that have produced a half billion in gold and silver since John H. Gregory's discovery of gold in 1859. The Teller House (1872), costing \$104,000 and named for Senator Henry Moore Teller, free-silver advocate, is still open for the summer season. The Central City Opera House (1878) is still standing. Since 1932 an Annual Play Festival is held there. The city was incorporated in 1886 and is governed by a mayor and council. Pop. (1950) 371.

CENTRAL CITY, town, Iowa, in Linn County, altitude 837 feet, on the Illinois Central Railroad. It is a trading center for farmer within a radius of ten miles. The town has a theater, a public library, a creamery, and a grain elevator. Pop. (1950) 965.

CENTRAL CITY, town, Kentucky, in Muhlenberg County, altitude 395 feet, 32 miles south of Owensboro, on the Illinois Central and Louisville and Nashville railroads. Coal, oil, and gas wells are nearby. The surrounding area raises tobacco, corn, hay, and garden produce. Pop. (1950) 4,110.

CENTRAL CITY, city, Nebraska, and Merrick County seat, altitude 1,705 feet, on the Platte River, and served by the Union Pacific and the Chicago, Burlington and Quincy railroads, and state and federal highways, 130 miles west of Omaha. It has a public library and is the seat of Nebraska Central College. It has a mayor and council. Pop. (1950) 2,394.

CENTRAL FALLS, city, Rhode Island, in Providence County; altitude 30 feet; on Blackstone River, adjoining Pawtucket; 4 miles north of Providence; and on the New York, New Haven and Hartford Railroad. An industrial city, it has textile mills and glass works (branch of the Corning, N. Y., works). Jenks Park and the memorial library were gifts to the city. In the park is a lofty memorial clock tower. The site of Central Falls was part of the town of Smithfield when the latter was cut off from Providence in 1730. It was incorporated with the town of Lincoln in 1871, and became a separate city in 1895. It is governed by a mayor and council. Pop. (1950) 23,550.

CENTRAL INDIA AGENCY, formerly the official British term for a collection of states and estates in Hindustan, with an area of 52,047 square miles and a population of (1941) 7,506,427. It was formed in 1854, and was an outgrowth of the interposition of the British government in Central India for the purpose of restoring order to a chaotic state of affairs that existed throughout that part of the country after the Pindari War in 1818. As a result of constant warfare and subjugation by invading forces, the territories of the different states became divided and intermingled. Their relations to one another and to the Indian government were various. Some were under direct treaty with the government of India; some were held under *sunnuds* and deeds of fealty and obedience; while others were held under agreements effected by the British government between them and their superior chiefs. The principal states were Indore, Bhopal, and Rewa, the largest of these being Rewa, with an area of 12,830 square miles and a population of (1941) 1,820,445. Indore was next in size, although first in importance because it was the residence agency; it had an area of 9,934 square miles and a population of (1941) 1,513,966. Bhopal was the smallest of the three, having an area of 6,921 square miles and a population of (1941) 785,322. In 1927, the king emperor recognized the right of a daughter of a ruler of Bhopal to succeed in the absence of a son; and a legislative council was established. In August 1947 all the territories became affiliated with the Indian Union.

CENTRAL OF GEORGIA RAILWAY COMPANY, a railroad company with headquarters at Savannah, Ga., and operating 1815.29 miles of track in Georgia and Alabama, including 4 miles to Chattanooga, Tenn. The company uses both diesel and steam power, but the trend is toward increased dieselization. Originally the road was incorporated Dec. 20, 1833, as Central Rail Road and Canal Company of Georgia, being the first railroad to be chartered in Georgia. In 1835 it was changed to Central Railroad and Banking Company of Georgia; and in 1895, it was given present name of Central of Georgia Railway Company. The first line completed was from Savannah to Ocmulgee River, near Macon, a distance of 191 miles. This line, completed in 1843, was for several years the longest railroad under one management in the world. The company is now in full corporate status, having emerged from trusteeship July 1, 1948. Two streamlined trains are operated—the *Man o' War* between Columbus and Atlanta, and *Nancy Hanks, II*, between Savannah, Macon and Atlanta. They

are the first streamliners to operate solely within the borders of Georgia. The company is joint operator with other railroads of the *City of Miami*, Chicago-Miami streamliner, handling this train from Birmingham, Ala., to Albany, Ga. Much attention is devoted to agricultural and industrial development in the area served, and complete staffs of agricultural and industrial experts are maintained.

CENTRAL PARK, New York City. Though now surpassed in size by several other park areas within Greater New York, Central Park is undoubtedly the most noted park in the metropolis, occupying, as its name implies, a central position in the Borough of Manhattan, the oldest borough of the city and the site of the city's first development. The park extends from 59th Street to 110th Street between Fifth and Eighth avenues and is 840 acres in extent.

In 1856, the year it was purchased by the city, the land now constituting Central Park was occupied by shanties, piggeries, and foul swamps nestled among rugged rock outcroppings. The site for the park was finally selected despite its uncompromising topography in preference to the location first proposed at 66 Street on the East River (Jones' Wood) because of its central position and greater area. An economic factor which was also considered at the time was the great expense of levelling off the site if it were to be adapted for building purposes, which would have entailed extensive filling of low swampy ground and blasting away of high rock ledges. It is interesting to note that the price paid for the park was about \$7,500 an acre, the total cost being \$6,348,959.90. The land has a present day valuation of \$645,250,000, an increase of over one hundredfold.

While many citizens, at the time of its purchase, readily predicted that the site would never lend itself for park purposes and that it was an unnecessary extravagance, plans were formulated and legislation enacted to go ahead with the improvement. As the result of country-wide competition, Frederick Law Olmsted and Calvert Vaux submitted plans which were chosen as the best of thirty designs and they were awarded the first prize of \$2,000.

Within a year construction work on the park was started under the jurisdiction of Olmsted, Vaux and Jacob Wrey Mould, an architect responsible for many of the early park structures. The original plan, now on display in the Park Department offices in the Arsenal in the park, was faithfully adhered to and the park today closely resembles that of seventy-five years ago, the most important change being the elimination of the lower reservoir of the old Croton system of New York City's water supply. This was filled in between 1930 and 1933 and, while many different schemes of development for the area were proposed, including a municipal music center, an elaborate war memorial, a huge swimming pool, and a golf course, it was not until 1934 that the present simple scheme for a Great Lawn was adopted, the area being completed in 1936.

Another change, and one which is quite apparent, has been the adaptation of the park to the requirements for active juvenile recreation. Robert Moses, who assumed the Commissioner-ship of the consolidated five-borough Park Department in 1934, found that, owing to the lack

of provision for active play, the park was deteriorating to an alarming extent through children's vandalism and directed the construction of 19 marginal playgrounds for small children around the perimeter of the park area. These playgrounds, located near pedestrian entrances, have been extremely successful in satisfying the need of children's recreation and it has become increasingly simpler to keep the balance of the park in good condition. In addition to these playgrounds the 29 acre North Meadow was laid out for active field games, two playgrounds were built in connection with the Great Lawn development, the centrally located playground in the southern part of the park which had been originally constructed with funds donated by August Heckscher, philanthropist, was enlarged and modernized, the Circle Lawn area for adults was reconstructed and another much-needed children's playground was built on the site of the Central Park Casino.

Other changes effected in the park under the jurisdiction of Commissioner Moses have been the replacement of the former unsanitary, unsafe menagerie with a modern, up-to-date zoo, and the conversion of the old conservatory and greenhouse group into a fine formal garden. The old Sheepfold, built in 1870-1872 as quarters for the park flock, used during the last century as the only means of keeping the lawns sheared, was converted, in 1934, into a modern restaurant with out-of-door dining terraces. This restaurant, known as the "Tavern-on-the-Green," serves moderate-priced meals to the public during the summer months. The present modest eating establishments in the Tavern-on-the-Green, the Zoo Cafeteria and the Boathouse on the Lake, replace, among others, McGowan's Pass Tavern, a famous old hostelry of the 90's where annually a magnum of champagne was donated to the first driver to reach the Tavern in his sleigh on the occasion of the first snowfall. The Central Park Casino, perched above the Mall, is another restaurant which has vanished from the scene. An eating place since the last century, it had become, in the late 1920's a pseudo-exclusive restaurant with exorbitant prices. After considerable litigation the Casino's management was ousted, the structure razed and the site developed as a playground for children.

While accurate figures are lacking, it is safe to say that over \$50,000,000 has been spent to date in bringing Central Park to its present condition. It is two and one-half miles long, a half mile wide and 147 of its 840 acres are in lakes and the large receiving reservoir of the New York City water-system. There are 35 miles of walks, 10¼ miles of road and five and one-half miles of bridle paths.

The Metropolitan Museum of Art occupies a site in the park fronting Fifth Avenue between 80th Street and 84th Street. Other items of interest are the Egyptian Obelisk, erected at the rear of the Museum, and the monument to the heroic dead of the U. S. S. *Maine*, situated at the southwest entrance to the park.

The Mall in Central Park is the center for special events. Band concerts are given in a band shell which was donated by Elkan Naumburg, philanthropist, and various other civic events and free entertainment, including free public dancing two nights a week during the summer months, are provided so that the Mall is used daily throughout half the year. Ten thou-

sand are easily accommodated in seats provided for the audience.

Activities in the park include boating in summer and skating in winter on the several lakes, lawn bowling, croquet, horseshoe pitching, model yachting, baseball, softball, hockey, football, riding.

An old count of visitors to the park made in 1861 showed an annual usage of 1,863,263 pedestrians, 73,547 equestrians and 456,849 carriages, the total number of visitors being estimated at 2,404,659. In comparison, in 1949, it was estimated that 4,697,000 people visited the park, of whom a large proportion were children in the various playgrounds.

CENTRAL PROVINCES AND BERAR,

a state in India, now called MADHYA PRADESH by the Constitution of the Republic of India, Jan. 26, 1950. The new state includes the Central Provinces and Berar and the 14 princely states of Chhattisgarh in the eastern districts. The state, an irregular square of land in central India between Bombay and Bengal has a total area, including the new acquisitions, of about 153,710 square miles. The population which was 16,813,584 in 1941 was increased to over 20,000,000 by the accession of the Chhattisgarh states. Madhya Pradesh is bounded in the northwest and north by the princely unions of Madhya Bharat and Vindhya Pradesh, in the northeast and east by Bihar and Orissa, in the southeast by Madras, in the south and southwest by Hyderabad, and in the west by Bombay. Physically the state may be divided roughly into three upland areas separated by two plains. The northwestern districts lie on the uplands of the Vindhya Plateau. South of this region are the wheat-growing plains of the Narbada Valley which are followed further south by the forested Satpura Range and the Nagpur Plain where the black soil is good for cotton growing. The eastern part of the Nagpur Plain lies in the valley of the Wainganga and is rice-growing country. Further east the Chhattisgarh region, also rice growing, is served by the upper reaches of the Mahanadi River. The southeastern extremities of the state are hilly and forested, until recently quite isolated, and inhabited by jungle tribes. The main rivers of the state are the Narbada, Wardha, Wainganga, and Mahanadi. The average rainfall for the whole state is about 47 inches, varying from 32 inches in the western parts dependent on the southwest monsoon to 62 inches in the east where the winter monsoon also operates. About one fifth of the state is not available for agriculture being hilly and wooded, but of the remaining land about 67 per cent is under cultivation. The percentage of rice to the total cropped area is 34, wheat 14, cotton 3, while pulses, cereals, oilseeds, etc., occupy 49 per cent. In 1945 there were 1,217 factories listed in the state which employed 110,263 persons. Nagpur, the capital, is a center for cotton spinning and weaving. Coal and manganese mined in the state in 1943 totaled 1,657,019 tons and 461,676 tons respectively. Marble and allied works such as limestone, pottery clay, and soapstone are operated around Jabalpur (Jabalpur). Four railways run in the state: the Great Indian Peninsular and Indian Midland; the Bombay, Baroda and Central Indian; the East Indian; and the Bengal-Nagpur. Two main routes connecting Bombay and Calcutta cross the state north and south of the Satpura Range.

Hindi is the lingua franca of the state, being spoken by 56 per cent of the people, while Marathi is spoken by 31 per cent. Oriya and Telugu are also spoken. Hindus numbered 13,336,372 and Moslems 682,854 in 1931, the last year in which the Indian Census included figures for religious affiliation. The administration was vested in a chief commissioner from 1861-1920, when the Central Provinces became a governor's province. The governor was assisted until 1935 by 8 secretaries and 6 undersecretaries, and after 1935 by a Council of Ministers summoned by him. The province after 1935 had a unicameral legislature of 112 members, and under the new Constitution of India, January 1950, it continues to be unicameral with 111 members. The new legislature is called the Legislative Assembly; representation in it is based on the scale of one member for every 75,000 of the population.

ROBERT O. SWAN.

CENTRAL RAILROAD COMPANY OF NEW JERSEY, The, a system operated in New Jersey and New York by The Central Railroad Company of New Jersey and controlled by the Reading Company which owns 57.52 per cent of the Class B stock. The company was formed Feb. 26, 1847 for the consolidation of the Elizabeth and Somerville Railroad Company and the Somerville and Eastern Railroad Company, and has since absorbed the Newark and New York Railroad Company, the Perth Amboy and Elizabeth Railroad Company, the Constable Hook Railroad Company, the Manufacturers Railroad Company, the South Branch Railroad Company, the High Bridge Railroad Company, the Longwood Valley Railroad Company, the Lake Hopatcong Railroad Company and Hibernia Mine Railroad Company. The lines owned amount to 360.24 miles, and the lines leased to 5.08 miles. The trackage rights held by the company total 45.20 miles.

Terminal facilities are extensive and include about five miles frontage in the Port of New York. While the Company's chief business is the moving of terminal freight, it also has a large commuting clientele, and furnishes through service in conjunction with the Reading and the Baltimore and Ohio railroads.

CENTRAL RAILROAD COMPANY OF PENNSYLVANIA, a system operated in Pennsylvania by the Central Railroad Company of Pennsylvania, a wholly owned subsidiary of The Central Railroad Company of New Jersey. The Company was formed Jan. 10, 1944 and is operating under lease since August 5, 1946, the lines of railroad in Pennsylvania formerly operated by The Central Railroad Company of New Jersey. The lines owned amount to 4.49 miles, and the lines leased to 184.82 miles. The trackage rights held by the company total 53.07 miles.

CENTRAL VALLEY, N. Y., town of Orange County; altitude 478 feet; 15 miles southwest of Newburgh; on the Erie Railroad. It is in a beautiful valley and there are large estates in the vicinity. The Palisades Interstate Park of New York and New Jersey, of which Bear Mountain is a part, and which comprises an area of 1,000 acres, lies to the east of Central Valley. Pop. (1950) 1,300.

CENTRALIA, Ill., city in Marion County,

altitude 490 feet, on the Illinois Central, the Chicago, Burlington and Quincy, and the Missouri-Illinois railroads, and, on state and federal highways, 60 miles by rail east of St. Louis and 252 miles southwest of Chicago. There is an airport just outside the city. The immediate environment of Centralia is industrial, but it is a business center for the southern part of Illinois, a rich farm belt. Fruit crops, particularly peaches, apples, Kieffer pears, and strawberries, have a high value. Extensive general farming and dairy farming is done in this region. The principal industrial activity is in drilling for oil and in refining it, but the city has factories in which shoes, stoves, ranges, heaters, and various cast iron articles are made. Originally a railroad town, Centralia is still a division point, with shops. The city has a public library. Centralia Junior College is located here. Founded in 1853, Centralia was made a city in 1859. In city-owned Fairview Park there are six oil wells; 12½ per cent of their production goes to the city. In 1938, in a referendum, the people of Centralia voted to use proceeds of these oil wells to build a new city hall. The town has commission government and the water system is municipally owned. Pop. (1930) 12,583; (1940) 16,343; (1950 est.) 18,500.

CENTRALIA, Mo., city of Boone County; altitude 884.53 feet; 22 miles northeast of Columbia, the county seat; on the Wabash, and Gulf, Mobile and Ohio railroads. It is in a fertile farming region, the farms raising corn, oats, hay, cattle and hogs. It ships coal and farm produce, and has manufactures of electrical line hardware and equipment, and hardwood lumber. Pop. (1940) 1,996; (1950) 2,500.

CENTRALIA, Wash., the Hub City of the Northwest, in Lewis County, is located midway between two great shopping centers, Seattle and Portland, on United States Highway 99, altitude 207 feet.

Since the settlement began in 1852 on the Oregon Trail, Centralia has developed into one of the largest cities in Southwest Washington.

Having a West Coast Marine type climate with a growing season of 173 days and an average rainfall of 45 inches, this is an ideal place to live. The temperature is moderate the year round, with no extreme heat in summer nor extreme cold in winter.

Being a shopping center, serving approximately 60,000 people, Centralia has many types of retail stores, ranging from small groceries to large department stores.

Four transcontinental railroads, a modern airport, leading bus lines, city buses, a radio equipped taxi service, dial system telephones and telegraph service, make up Centralia's transportation and communication conveniences.

The city has a modern publishing house for the newspaper that serves nearly 9,000 people daily.

Another important factor in the communication system is radio station KELA located between Centralia and the neighboring town of Chehalis.

A large Carnegie library and city park are located in the center of town. Lumbering is one of the major industries. Other important industries are coal mining, logging, manufacturing of

furniture and plywood products, glove and shoe factories, ice plants, modern bakeries, canneries, a candy kitchen and two large chick hatcheries.

Agriculture is a major industry, surpassed only by lumbering. There are about 4,200 farms covering 274,000 acres. There is a long pasture season, and an abundance of logged-off land for pasture use. The rainfall is adequate so that in most cases irrigation is not necessary. Grasses average from 3 to 5 tons per acre. The farmers may join the cooperative marketing group if they so desire. Some of the important agricultural activities are sheep raising, berry farming, dairy-farming, poultry raising, and vegetable and grain farming.

Near by is a modern armory and the National Guard has a large unit stationed here. There is a Navy training electronic school where various types of electronics are taught.

Centralia has one of the most fully developed school systems in Southwest Washington.

Centralia is one of the few cities in the United States that have a golf course within walking distance. There is an abundance of fine salmon and trout fishing in the streams near by. Hunting bear, deer and wild birds is enjoyed during their respective seasons and there is a modern state game hatchery adjacent to the city. The majority of the large fraternal organizations is represented. For year around entertainment there are theaters, bowling alleys, youth recreation center, and a skating rink.

The city government is commission form with a mayor and two city commissioners. The hydro-electric plant and municipal water system provide this city with ample, inexpensive power. And Centralia is proud to claim one of the most efficient and inexpensive systems in the United States. Pop. (1940) 7,414; (1950) 8,657.

CENTRANTHUS. See VALERIAN.

CENTRARCHIDAE, sĕn-tră'r'kĭ-dĕ, a family of fresh-water percoid fishes, confined to North America. The body is generally short, deep and compressed, with an equal curvature above and below, and covered with rather large, strong ctenoid scales. The mouth is terminal, variable in size, with the premaxillary protractile, and numerous fine, close teeth on all of its bounding bones. Both dorsal and anal fins are long, with 6 to 13 strong, sharp spines in the anterior part of the former, and 3 to 8 in the latter. All are active, pugnacious, carnivorous fishes, many of which build nests. They are important game and food fishes of small or moderate size, of which about 12 genera and 30 species are known, almost all of which are confined to the Mississippi Valley and the eastern United States, where they are almost the most characteristic fishes. The most important are the grass bass, black bass, rock bass, warmouth and sunfish.

CENTRE, Ala., county seat of Cherokee County; alt. 720 feet, on U.S. Highway 411, and 34.8 m. W. of Rome, Ga. Settled in the early 1840's and so named because of its central location in the county, Centre became the county seat in 1844. It was the home of John Jonathan Pratt, inventor of the pterotype, a precursor of the modern typewriter, described in the July 6, 1867 issue of *Scientific American*. Models of Pratt's machine are preserved in the Smithsonian

Institution, Washington, and the Kensington Museum, London. The inventor's grave is under a clump of oaks two miles west of the town. The *Coosa River News*, founded in 1878, is the local paper, and is still printed on a hand press. A mile from town is the Garrett House, built in 1830, and behind it the grave of Pathfinder, last chief of the local Cherokee tribe. Across the Coosa River is the site of Turkey Town, largest Indian town in Alabama in the early 19th century. The Cherokee of the district assembled there in 1837-1840 for their removal to Indian Territory. Pop. (1950) 1,672.

CENTRIFUGAL. A centrifugal (or centrifuge) as generally known, is a machine having a hollow rotor into which a mixture of liquids or a mixture of solids and liquids may be fed in such fashion that the mixture will be separated into its component parts by centrifugal force.

Though centrifugal governors, centrifugal pumps, centrifugal traps and centrifugal casting machines are all centrifugal machines, none is a centrifugal. Cream separators, centrifugal oil purifiers, sugar centrifugals and centrifugal laundry dryers are all "centrifugals."

From \$10,000,000 to \$20,000,000 worth of centrifugals are sold in the United States annually, and considerably over one half of this amount represents centrifugal cream separators.

For over 100 years centrifugals with large perforated rotors ("whizzers") have been used for the removal of liquids from such solids as sugar, and textiles. Since 1880 centrifugals have been used as cream separators. Some 2,000,000 cream separators are in use in the United States. The first cream separator was invented by the Cie de Fives Lille (France) in 1876. Cream separators were first manufactured in the United States (in 1887) by P. M. Sharples.

It is only since 1915, however, that centrifugals have been used for a wide variety of separations and purifications in chemical and other industrial plants. There are now over 400 different applications in the chemical, petroleum, and food industries for high-speed centrifugals of the general type of the cream separator.

Centrifugals are used (a) to separate two liquids, (b) to remove solid particles that are suspended in a liquid, and (c) to remove excess liquid that is in contact with solid matter. A description of several uses of centrifugals may be more interesting than descriptions of the machines themselves. Examples in each category are:

Category (a)—To separate two liquids:

Example 1: *Separation of cream from milk.* About 99 per cent of the cream that is in a given batch of whole milk may be removed by a centrifugal. The milk is fed through continuously and remains in the rotor but 5 to 15 seconds in order to accomplish this very complete separation. Only the extremely small fat globules remain in the skimmed milk, which latter will analyze about .04 to .08 per cent fat. By gravity separation in pans overnight only about five-sixths as much cream will be obtained, and the aging of the products incurred is a detriment.

Example 2: *Caustic Treating Vegetable Oils.* Cottonseed oil and other vegetable oils are commonly freed of free-fatty-acid by treatment with caustic. The mixture is then passed through a centrifugal for the removal of the reaction

products. These products can be, and until recently always were, removed by gravity settling, but the loss of oil with the removed impurities by that method is about 50 per cent greater than by the centrifugal method.

Example 3: Concentration of Rubber Latex. As the juice, or latex, comes from the rubber trees, it will contain some 25 per cent to 35 per cent of rubber in suspension. By passing this latex through a centrifugal, serum will be separated out and the resulting fluid concentrate will contain approximately 60 per cent rubber in suspension. This fluid concentrate can then be shipped with reasonable economy from the plantation to the country of ultimate manufacture, where rubber articles of superior quality can be produced, as compared with articles made from crude rubber in its solid form.

Example 4: Separation of Fish Oil from Water. In the manufacture of fish meal and fish oil, the fish are cooked in bulk, and pressed for the removal of liquids. The press effluent contains much water and some fish oil which latter is recovered by passing this effluent through a centrifugal. The recovery is practically complete and is so quickly accomplished that decomposition is prevented. This centrifugal separation has largely replaced the older method of gravity separation in tanks. In the latter case the solids present in the press effluent would decompose, thus lowering the quality of the oil. Furthermore, much oil would be lost.

Example 5: Dehydrating Insulating Oil. Transformers are usually filled with oil which acts as an electrical insulator between the wire coils and as a means of conducting away heat. It is common practice to pass this oil, at infrequent periods, through a centrifugal for the removal of moisture and other impurities, as these reduce the insulating power of the oil.

Example 6: Orange Oil from Orange Juice. When oranges and lemons are squeezed for the quantity production of juice, a small quantity of the valuable oil from the skins mixes with the juice. By passing the juice through centrifugals this oil is recovered.

Example 7: Wool-Grease Recovery. Wool, when shorn, is greasy with the body grease of the sheep. As the dirty wool is scoured in a bath of soap, alkali, and water, this grease and much other dirt is transferred to the scouring bath. By centrifuging these liquors, the grease is recovered. Some \$20,000 worth of this grease may be recovered annually from a pair of scouring trains. This wool grease, called lanolin when purified, is valuable as the base of salves owing to its power of penetrating the skin.

Category (b)—To remove solid particles that are suspended in a liquid:

Example 1: Purification of Lubricating Oil. When in use, lubricating oil becomes contaminated. When used in Diesel engines, it becomes contaminated with particles of carbon, sand, metal, water, acid, and sludge. By continually circulating this used oil through a centrifugal, the oil may be kept clean enough for use without damaging the engine's bearing surfaces.

Example 2: Separation of Wax from Lubricating Oil. An automobile lubricating oil, unless dewaxed, would become so viscous in cold weather that it would not pour, and the engine would be difficult to crank. This undewaxed oil would contain some 10 per cent to 20 per cent of wax. To dewax the oil centrifugally, it is

first diluted with a solvent, then chilled to perhaps -30°F. to solidify the wax, then passed through a centrifugal running at 15,000 r.p.m. The solvent is then removed from the oil by distillation.

Category (c)—To remove excess liquid that is in contact with solid matter:

Example 1: The large majority of the water is removed from wet cloth after laundering by placing the wet cloth in a perforated rotor of 20" to 50" diameter, and rotating it until the water is thrown off.

Example 2: In a similar way, the syrup is removed from sugar in sugar refining operations.

Example 3: Mother liquor is removed from ammonium sulphate crystals produced in a by-product coke plant. The centrifuged crystals will analyze about 2 per cent free moisture.

Centrifugals may be divided into the following mechanical classifications: (a) The Super-Centrifuge; (b) the disc-bowl centrifugal; (c) the self-cleaning disc-bowl centrifugal; (d) the continuous peripheral discharge centrifugal; (e) the batch centrifugal; (f) the continuous solid-discharge centrifugal; (g) the ultracentrifuge; (h) the bottle centrifugal. In industry the proper general type must, of course, be selected if optimum results are to be obtained in the centrifuging of any given mixture, and the proper model of the general type must be selected. A brief description of each classification and its use follows:

(a) The Super-Centrifugal. This generates the highest centrifugal force available for general industrial use. The 2" to 4" diameter rotors revolve at from 50,000 to 15,000 r.p.m. and generate centrifugal force equivalent to from 60,000 to 13,000 times the force of gravity. The fluid mixture is fed continuously into one end of the rotor, the separation takes place as the fluid flows through the rotor, and the separated fluids issue from separate ports at the exit end of the rotor. Any solid impurities that separate out remain deposited on the walls of the rotor and must be cleaned out at the end of the run.

(b) The disc bowl centrifugal. This machine runs at about one-half the r.p.m. of the Super-centrifugal but has a good efficiency due to a stack of cone-shaped discs which fill the bowl. These stratify the liquid in the bowl and thus render separation more rapid than it otherwise would be. In some instances the discs present a cleaning problem. Uses for this machine are largely identical with uses for the Supercentrifugal.

(c) The self-cleaning disc bowl centrifugal. Valves in the periphery of the rotor of this machine open themselves at intervals while it is in full speed operation and the solids are thus permitted to discharge through the peripheral openings. Such centrifugals are used where the liquids to be purified contain a relatively high percentage (say 1 per cent to 5 per cent) of insoluble solids.

(d) The continuous peripheral discharge centrifugal. This is a disc-bowl centrifugal so built that continuously it will disgorge itself of insoluble solids through nozzles near the bowl periphery. These solids, if allowed to accumulate, would fill and clog the bowl.

(e) The batch centrifugal. This is sometimes called a whizzer, a dryer, or a basket centrifugal. The rotor is usually from 30" to 80" diameter, and is usually perforated and lined

with wire screen. A slurry of granular salts and mother liquor may be placed in the rotor and as it revolves the liquid is thrown off through the perforations. While in the rotor, the salts may be rinsed with a spray of water. Periodically the dewatered salts are removed from the rotor. Bulk centrifugals are sometimes made so that they load, rinse the solids, dry them and unload them, all entirely automatically. These machines are sometimes made with imperforate baskets for purifying liquids. They usually generate a centrifugal force of only 500 to 1,500 times gravity, and therefore in spite of their size (in fact because of it) do not have the clarifying power of the smaller high-speed centrifugals previously described. Higher unit forces applied over such a large diameter rotor would burst it.

(f) The continuous solid-discharge centrifugal. This type machine usually has a mechanically driven plow which continuously plows the sediment out of the rotor as fast as it is deposited from the mixture flowing through it. This type machine is made with perforate as well as imperforate rotors, and in general is to be used for the same type work as the batch centrifugal.

(g) The ultracentrifuge. This is a small machine for laboratory work which revolves at extremely high speeds, generating a centrifugal force of from 100,000 to 7,000,000 times the force of gravity. The rotor usually operates in a very high vacuum (about .2 micron of Hg pressure). The use of vacuum prevents air friction on the rotor which would cause heating of the liquid sample in the rotor, which in turn would cause convection currents that would damage the extremely high separating efficiency of the centrifugal. The highest speed rotor ever made is $\frac{3}{16}$ inch diameter and runs at 6,600,000 r.p.m. generating a centrifugal force of over 13 million times the force of gravity.

(h) The bottle centrifugal. This centrifugal has a rotor made to hold several calibrated glass containers so that samples to be tested for laboratory analysis may be spun for a period, then removed so the percentage of settled material may be measured.

Evidences of centrifugal force continuously surround our everyday life. When a motor car proceeding down a street is forced to turn a corner by the action of the front wheels, the car as well as everything in it tends to continue straight on down the street. Centrifugal force has created this tendency. If an upright, half-filled bottle is fastened off-center on the top of a turn-table, and the turn-table is revolved at high speed, the water in it will be forced against the outer side of the bottle, and the surface of the water will go from a horizontal into a vertical position. If the water is muddy, the dirt particles will tend to go toward the outer side of the bottle, and soon the water will be clear and the mud will appear in a layer against the outer side of the bottle. If some oil had been mixed with the water, both the oil globules and the water would attempt to go to the outer side of the bottle, but the water being the heavier would have the preponderance of power and the oil globules would have to give way to the water. Hence, the oil globules, in spite of their desire to go outward, would go inward, because all the outward space would be pre-empted by the heavier water. Eventually one would find the mud on the outer side, next to it would be the water, and on the surface of the water would be

found the layer of oil particles. If the turn-table is now speeded up to four times its previous r.p.m., the mud particles will have 16 times (i.e. the square of 4) as great a tendency to reach the outer side of the bottle.

In this homely example are found the underlying principles of the high speed centrifugal. The liquid is revolved in a rotor at such high speed that mud will force itself outward to the wall of the rotor in a matter of a few seconds, and the oil globules will form a layer on the inner tubular surface of the water. A column of air will be found up the axis of the rotor. As more water is jetted into one end of the rotor, an equal amount of separated water and oil will emerge, or overflow, from the other end, and we have a continuous centrifugal in action. The oil and the water are permitted to overflow through separate outlets so they may be captured separately.

The earth may be considered as an enormous centrifugal rotor. The earth revolves at a speed of only $\frac{1}{1440}$ th of a r.p.m. Hence, in spite of its great diameter the centrifugal force generated is so slight as to be scarcely noticeable. A man weighed by a spring scale would weigh about one pound lighter at the equator than at the pole. The Mississippi River is caused to flow uphill by the centrifugal force generated by the rotation of the earth. The mouth of the Mississippi is about 3 miles higher than its so-called upper waters. The surface of the ocean is some 30 miles higher (further from the center of the earth) at the equator than at the north pole.

Following is the formula for centrifugal force:

A body revolving in a curved path of radius R in feet exerts a force called centrifugal force F upon the arm or chord which restrains it from moving in a straight line, or "flying off at a tangent." If W = weight of the body in pounds, N = the r.p.m., then

$$F = .00034084 WRN^2 \text{ lbs.}$$

Not all separation problems are most economically handled centrifugally. In industry there are five commonly used physical methods of separating liquid from liquid or removing solids from a liquid: (1) gravity settling; (2) filtration; (3) centrifugation; (4) distillation; (5) crystallization. Economic considerations usually determine which method will be used. If the solid particles will settle out readily from a liquid by gravity in a settling tank, method (1) may be the most desirable. (Example: settlement of mud from city water supply.) If the particles won't settle out readily but can be readily screened or filtered out, method (2) may be preferable. (Example: filtration of cement from a slurry.) If the particles won't settle readily and won't filter properly, method (3) may be the most desirable method. (Example: separation of cream from milk.) When the component parts of a liquid-liquid mixture are in solution one in the other, method (4) may be the most desirable. (Example: distillation of alcohol from water.) When a solid is dissolved in liquid, method (5) may be the most desirable. (Example: crystallization of sugar from a sugar-in-water solution.)

See also PUMPS AND PUMPING MACHINERY—*Centrifugal Pumps.*

L. P. SHARPLES,
Vice President, The Sharples Corporation, Centrifugal and Process Engineers, Philadelphia, Pa.

CENTRIFUGAL FORCE, a phrase used to express the tendency manifested by a body revolving about a center to fly away. See also **CENTRIFUGAL**.

CENTRIFUGAL PUMPS. See **PUMPS AND PUMPING MACHINERY**.

CENTRIPETAL FORCE, that force operating on a body moving in a curve which tends to draw the body to the center of the curve. A moving body tends to move in a straight line. It may be deflected from its course into another straight line by some other impulse. If it is held continually to a curved path, it is under the influence of a centripetal force. A common illustration is the movement of the earth in its orbit. The inertia of the earth's motion tends to send it flying off into space in a straight line, tangent to the curve of its orbit. The attraction of the sun is the centripetal force which overcomes its inertia so far as to hold it steadily to the curve of its path around the sun. If the earth's forward motion were suddenly checked, the sun's centripetal attraction would draw it straight to the sun's center.

CENTROCLINAL FOLD. See **FOLDS**.

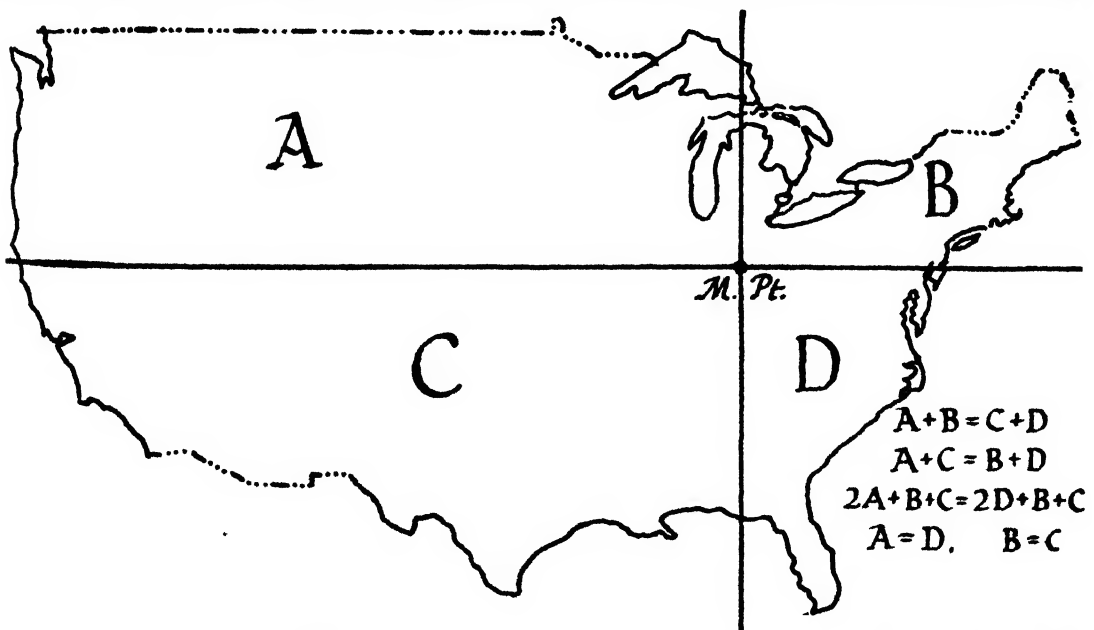
CENTROGRAPHY. The term implies the finding and recording of the geographical centers of population, area, wealth, or any other distribution on the earth. A map or cartogram recording such distribution is called a centrogram. To find the center of population of a country is in itself interesting enough, but if the trends of several years or decades can be established, important facts are revealed for land planning. The correlation of various centers, such as area and population, may bring out many hidden geographical relationships. Indeed, centrography became so important that a special organization, the Mendeleev Centrographical Laboratory, was established in Leningrad. Centrograms of cities and business areas are often prepared by telephone

companies, public utilities, and business firms. By establishing and projecting local trends, they have a scientific basis for buying real estate, and establishing branch offices.

There are various kinds of centers. The simplest is a *median point*. The usual way to arrive at a median point is the following. For instance, the median point of the population of the United States can be found by selecting a likely meridian and counting the population on one side of it. If it is less or more than half, then we have to move it until the population on both sides becomes equal. The same process is performed with a parallel, and the intersection of the parallel and the meridian is the median point.

Population will be equal in A and D quadrants (Fig. 1) and in B and C quadrants, but not necessarily the same in A and B. If we select two other lines than a parallel and a meridian, the result will be nearly but not exactly the same; the greater the number of units involved, the nearer will the results come. Many practices of centrography do not work well if very few individuals are involved. The method has another inaccuracy also. While the meridian is a great circle, and so the straightest line that can be drawn on a globe, the parallel is not. For exact work a great circle perpendicular (east and west) at the median point should be used instead of a parallel. It is obvious that the median point does not record the distance of the people from the center. The whole population of Illinois might move to Oregon without affecting the median point, the median point of the population of the United States being in west-central Ohio.

For most studies the median point will be sufficient, but if the distance is also to be considered we use the *center point of gravity*, or the *pivotal point*. The *Statistical Atlas of the United States 1874* (compiled by F. A. Walker) defines the center of population as a point upon which the United States would balance if it were a rigid plane without weight and the population were distributed thereon, each individual being



1. - The median point of population is located by bisecting the population with a meridian and with a parallel. (After Sviatlovsky and Eells, *Geographical Review*, 1937.)

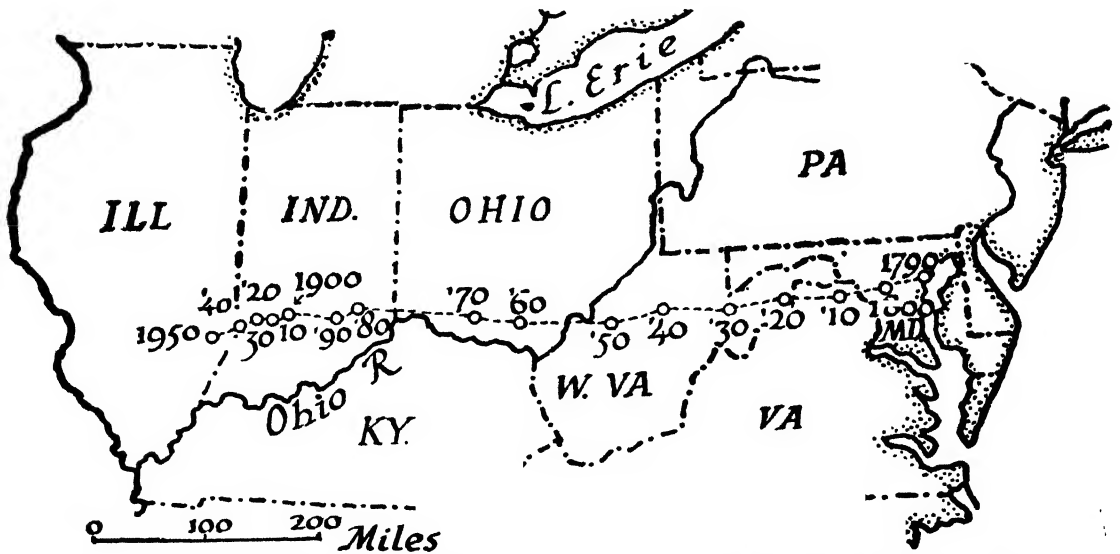


Fig. 2.—The center point of gravity of the population of the United States progressed from Baltimore in 1790 to Illinois in 1950. (After U. S. Bureau of Census.)

assumed to have equal weight and to exert an influence on the central point proportionate to his distance from the point.

The finding of the pivotal point is similar to that of the median point. First we assume a central meridian and calculate the east-west momentum, and shift the meridian until east and west balance; then we do the same with a parallel; and the intersection will be the pivotal point. As we have to add individual distances instead of simple numbers, the calculation is far more involved than in the median point. The usual way is to find the center point of each state separately and work with the momentum of the state centers. The *pivotal point of the population* of the United States is near Carlisle in western Indiana. (Fig. 2.)

The steady westward migration of the center of population from Baltimore in 1790 to Olney, Ill., in 1950 is one of the most significant facts of

American history. This westward trend has slowed down since 1930; however, with the wartime industrialization of the West, the center is expected to be deep in Illinois in 1960. The *center of gravity of the area of continental United States* could be obtained by drawing on cardboard a map in azimuthal equidistant projection centered on the assumed center point, and cutting it out along the shore lines and balancing it on a pivot. Even this method would have a slight error and for still greater accuracy a spherical surface would have to be used. This center is near Lebanon, in north-central Kansas.

A third kind is the *center of minimum aggregate travel*. If all the people of a country would fly along straight lines to a national convention, the place which would require the least mileage would be such a center. According to most authors, this is identical with the center point of gravity, but according to W. C. Eells the points

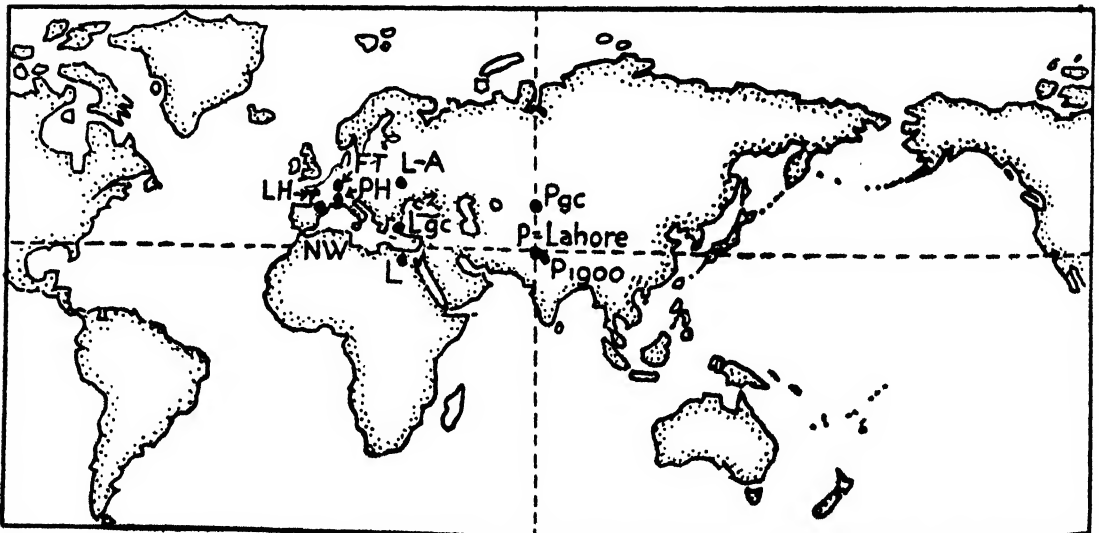


Fig. 3.—Median points. P = Population. P1900 = Population in 1900. Pgc = Population, using great circles. L = Land area. Lgc = Land area, using great circles. L-A = Land area minus Antarctica. NW = National wealth. LH = Land hemisphere. FT = Foreign trade. PH = People's hemisphere. (After Raisz, *Journal of Geography*, 1944.)

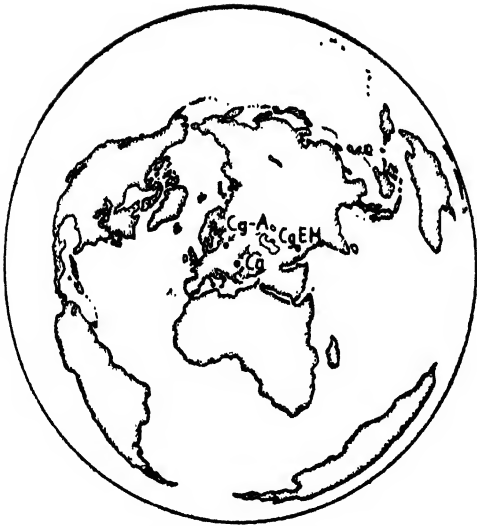


FIG. 4.—Centers of gravity of land areas. Cg = Center of gravity of all lands. Cg-A = Center of gravity of all lands minus Antarctica and Greenland. CgEH = Center of gravity of Eastern Hemisphere without Antarctica. (After Raisz, *Journal of Geography*, 1944.)

are not identical, especially if only a few individuals are considered.

Global Centrography.—Centrography, though laborious, is simple enough if the areas involved are so small that the spherical form of the earth is negligible, but to calculate the various centers of the whole earth allows for many interpretations.

Median Point of Land Areas.—Intersection of median meridian with median parallel locates one kind of center. There would be just as much land north of this point as south of it, and east and west would also balance. The problem can best be worked out on a cylindrical equal-area projection, and this point was located near Farafra oasis of Egypt.

A more significant median point can be found, if we bisect the earth's land area by a meridian

and a great circle perpendicular to it. This point is near Izmir in Turkey, and if we do not consider the ice cap of Antarctica as land the median point will be near Ternopol, Ukraine. (See Fig. 3.)

The center of gravity of land areas was obtained by taking a very light terrestrial globe and covering all the land areas with a sheet of lead of even thickness, then immersing it in water. The globe came to rest with a point on top representing the center of gravity of oceans and with a point at the bottom which is the center of land areas. This point is on the Black Sea border of Rumania, not far from Varna, Bulgaria. If we do not regard the ice caps of Greenland and Antarctica as land, the center will be near Baranovichi in White Russia (formerly Poland). The locations of these centers are significant. They all are found on a line where "East meets West" between Europe and Asia or the Soviet Union, and they are significant as future hubs of air communication. (See Fig. 4.)

Land and Water Hemisphere.—A land hemisphere is the half globe with the greatest amount of land. Although British atlases center it on London, and German atlases on Berlin, the actual center of the land hemisphere is near Nantes, France. Eighty-one per cent of all land is in this hemisphere and, if we do not regard Antarctica as land, the percentage rises to near 90, a really uneven distribution of land over the earth.

Centers of the Earth's Population.—The distribution of land on earth is uneven enough but still more unevenly are distributed the inhabitants of these lands. We can define a "people's hemisphere" as the half of the earth with most people in it. This hemisphere centers near Mont Cenis in the French Alps and contains 94½ per cent of the earth's population, a surprising concentration of the earth's people.

The median point of earth's population can be figured by bisecting the earth's population by a meridian and by a parallel. This kind of median point would show up well in a Mercator projection of any map with horizontal parallels.



FIG. 5.—Decilides of area and population. (After Sviatlovsky and Eells, *Geographical Review*, 1937.)

There are just as many people east of it as west of this point, and the same north and south of it. The opposite sectors, as northwest and southeast, will have the same population too. As for our common geographical conceptions, this seems to be the most satisfactory center and is located near Lahore, India, for 1940. The center has been calculated also for 1900 and is also near Lahore, India, although the earth's population was then 30 per cent less. This result is very remarkable as it shows uniform growth of the earth's population in all its four sectors. The median point, derived by bisecting with a meridian and a perpendicular great circle, is near Lake Balkhash in the Kazakh SSR.

No attempt was made to find the center of gravity of the earth's population because the result would not be significant. Any person near the antipodal point would shift the center point to an unproportionate extent, although it would matter but little to him from which direction to approach the center.

The Center of the Earth's Wealth.—Although the statistics here are less reliable, yet this line is conditioned so much by the parallels of New York and Chicago and by the meridians of London and Paris that this median point can be located with fair exactness in the eastern Pyrenees. Less significant but based on better data is the center of foreign trade which is on the Swiss-French-Italian border.

In these studies three groups of centers are apparent. While the centers of land area cluster around Istanbul (Constantinople), the centers of population in India, all the other centers—wealth, foreign trade, land hemisphere, people's hemisphere—cluster in and around France. It is likely that if the centers of culture, inventiveness, political and military power could be found, they also would center in western Europe. This central position with all its assets and liabilities will shape Europe's destiny for a long time. The increase of air transportation, the conquest of tropical diseases, and greater political and social security will result in a more even distribution of wealth and people over the earth, and the three groups of centers are likely to approach each other in the future.

Quartilides, Decilides, etc.—In establishing the median point of the population, we bisected the population of a country by a meridian and by a parallel. If instead of bisecting we divide the population into four, ten, or any other number of equal parts by meridians and parallels, we obtain quartilides, decilides, etc. These centers help to study local trends.

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ERWIN RAISZ,
Institute of Geographical Exploration, Harvard University.

CENTROSOME, sən'trô-sôm, a term coined by Theodor Boveri in 1895, for the small bodies which Pierre J. van Beneden had earlier noted at the poles of the mitotic spindle of dividing

cells. Boveri saw within the centrosome of animal cells two smaller granules, which he called centrioles. The centrosome has been shown to be a transient structure, merely the innermost part of the aster of the mitotic figure. The centrioles, however, persist through the period between cell divisions, as a closely adjacent pair of minute bodies which are rarely over a hundred-thousandth of an inch in diameter. Centrioles stain intensely with such dyes as hematoxylin and crystal violet. They are also identifiable by their characteristic position in each type of cell; for example in a concavity of the nuclear surface (leucocytes, connective tissue, smooth muscle), just beneath the distal end of the cell (epithelia).

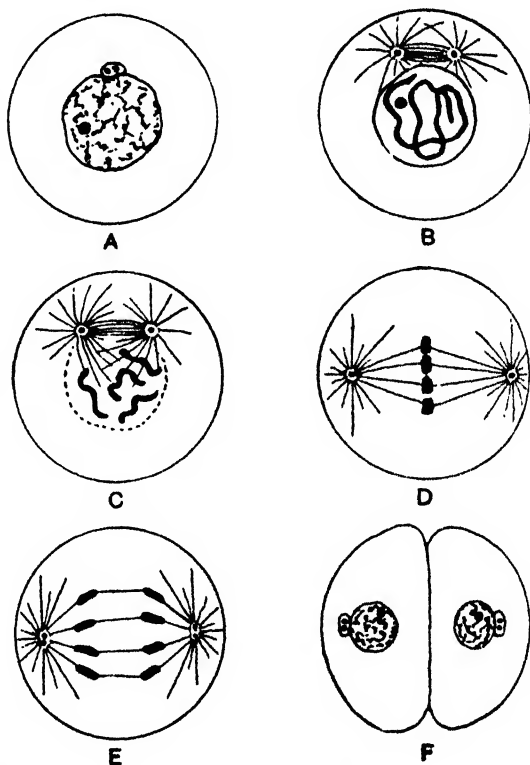


FIG. 1.—First division of an egg in which segmentation is complete. A, fertilized egg with nucleus and two centrosomes. B, the two centrosomes have moved apart, radiations have formed about them, and a "spindle" has developed between them. C, the wall of the nucleus is breaking down and fibers of the spindle are becoming attached to the chromosomes. D, the spindle is fully formed and the chromosomes have been drawn by it into an equatorial position. E, the chromosomes have divided and are being drawn to the two poles of the cell by the spindle. Each centrosome has divided. F, the first two cells of the embryo have been formed, each with two centrosomes ready to repeat the process at the next division.

In many types of animal cells there is no visible evidence of any function for the centrioles during the time between divisions; but in leucocytes an aster is developed about the centrioles, while in spermatozoa and unflagellated epithelial cells the vibratile process grows out from the centriole.

Centrioles are of great importance in cell division (Fig. 1). At prophase they separate and take up positions at either side of the nucleus, thus determining the location of the spindle and of the plane of cleavage which divides the parent cell into two daughter cells. While located at the spindle pole each centriole divides

to assure the double number to each daughter cell.

The facts summarized above are the basis of the view that in animal cells the centriole is a permanent cell organoid, which is self-perpetuating in much the same fashion as the chromosomes. The great puzzle about centrioles is concerned with the situation in plants. In many algae the facts appear much like those in animals (Figs. 2 and 3); but in gymnosperms and angiosperms the most diligent search has failed to establish the presence of a centriole in any cells, even at mitosis. In dividing cells of these plants, the spindle is barrel-shaped, and there is no hint of centrosome, centrioles, or asters. This could be interpreted as a permanent loss of the centriole-organoid in these plants; but this cannot explain the fact that in many mosses there are barrel-shaped spindles without centrioles throughout most of the life cycle, while spindles with centrioles appear in later generations of the plant, in those cells which are to give rise to the flagellated spermatozoa. It has always appeared therefore that in these mosses centrioles could not have arisen by division of pre-existing bodies of the same sort.

Recent researches have indicated that the centriole, although it is located in the cytoplasm,

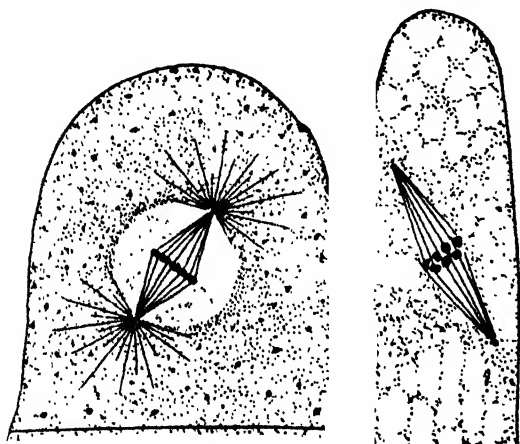


FIG. 2.

FIG. 3.

is actually to be compared with a nuclear structure, the centromere of the chromosomes, a region to which the spindle fiber attaches at mitosis. In abnormal sperm formation in snails, it has been shown recently that the centromeres can become detached from degenerating chromosomes, enter the cytoplasm, and there behave exactly as if they were so many extra centrioles. It has been suggested that in the centromeres of the chromosomes there is, then, a permanent reservoir of centriolar substance, which could possibly be the source of the centrioles which appear so mysteriously in the sperm-forming cells of mosses.

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ARTHUR W. POLLISTER,
Professor of Zoology, Columbia University.

CENTUMVIRS, sĕn'tŭm-vĭrs (Lat. *centumviri*, 100 men), Roman jurors competent to judge all cases in civil law except those concerning contracts, torts, and possession. Suits

involving questions of law rather than of fact were referred to them. No special qualification for membership is known, but the centumvirs seem to have been chosen from the upper classes. Sometimes they sat as a unit; more often they met in two or four sections, over which presided decemvirs (q.v.) as assistants to the hastarian praetor (q.v.), who nominally was their head. Decision was by majority ballot.

Originally 105 in number (3 elected annually from each of the 35 tribes among which Roman citizens were apportioned), when this panel was established about 150 B.C., the maximal strength reached 180 about 100 A.D. Our last certain reference to them is about 235 A.D.

CENTURIES OF MAGDEBURG, a history of the early Christian church, so called because it was divided into centuries, each of the 13 volumes covering a hundred years, and was first written at Magdeburg. Matthias Flacius Illyricus formed the plan of it in 1552, but the last volume did not appear until 1574. It is the first comprehensive work of the Protestants on church history; its main purpose was to prove agreement of Lutheran doctrine with that of primitive Christians, and the difference between the latter and that of the Roman Catholics.

CENTURION (Lat. *centurio*), in the Roman army one of the principal professional officers. He commanded a century (*centuria*), of which there were 60 in a legion. Theoretically a century comprised 100 soldiers, but the usual legion strength of about 6,000 men meant that the command of a centurion was normally about 60 soldiers. In general his rank and functions corresponded to those of a captain in modern armies. However, there were various degrees of rank among centurions; some of them fulfilled functions more like those of field than of line officers in modern armies. During the Republic they were promoted from the ranks; but under the Principate (Augustus and his successors) some were former equestrians (*ex equite Romano*) or former praetorians who chose a legion career because of the higher pay—it was five times that of a praetorian soldier—and better prospects on retirement. After the army reforms instituted by Gaius Marius (157–86 B.C.) during his consulships, each of a legion's ten cohorts had six centurions called, respectively, *pilus primus*, *pilus posterior*, *princeps prior*, *princeps posterior*, *hastatus prior*, and *hastatus posterior*. In nine of the cohorts there was little rank difference between centurions, but those promoted to the first cohort, having entered the *primi ordines*, were in a group where strict seniority prevailed, *pilus primus* ranking first. The Praetorian Guard also had centurions, as did the *Auxilia* which in the 2d century A.D. became assimilated to the legions.

CENTURIPAE, chân-tồ-rê-pâ, commune of Sicily, Italy, in the Province of Enna, 21 miles northwest of Catania, at an altitude of about 2,300 feet. It is an agricultural center and has sulphur mines in the vicinity. Located on the site of ancient Centuripae, which was colonized by the Greeks in the 4th century B.C., it became one of the most flourishing towns of Sicily; its prosperity continued well after the Roman conquest, as stated by Cicero. Excavations brought to light extensive necropolises, beautiful terra-cottas,

painted vases, and coins. It was destroyed in 1232 by Emperor Frederick II who resettled the inhabitants in Augusta (Agosta). Pop. (1951) commune 10,934.

CENTURY, in *chronology*, a period of 100 years. Modern chronology of Christian nations centers at the birth of Christ, and the centuries are numbered according to their order either before or after the event, for example, the 20th century A.D., the 4th century B.C. See also individual centuries such as **FIRST CENTURY** or **SECOND CENTURY**.

In *Roman times* (1) a division of 100 men in the army, corresponding to the modern company, 60 of which formed a legion; (2) a division of the six classes of the people, introduced by Servius Tullius, for the purposes of taxation and voting. See also **COMITIA**.

CENTURY PLANT, a popular name of the *Agave americana*. See **AGAVE**.

CEORL. See **CHURL**.

CEOS or **KEOS**. See **KĒA** or **KEOS**.

CEPHAELIS. See **IPECAC**.

CEPHALASPIS, sĕf-ă-lăs'pĭs, an extinct genus of armored fish, ostracoderm, of the Devonian period. This form and its relatives had characteristic external armor of bony rings or plates, a backbone of gristle, and presumably were the forerunners of modern fish. Fossil remains are found in large numbers in the red sandstones of Scotland, and in Quebec, Nova Scotia, and New Brunswick.

CEPHALIC INDEX, one of the standard measurements used in anthropometry, is the ratio of greatest width to greatest length of the head, expressed in percentage, the maximal length being counted as one hundred. If the skull is measured instead of the head, the term "cranial index" is sometimes used. If the breadth-length ratio is below 75 per cent the head (or skull) is said to be dolichocephalic or long-headed, if between 75 and 80 per cent it is meso- (or mesati-) cephalic, and if 80 per cent or above it is brachycephalic, short (or broad) headed. See also **ANTHROPOLOGY**.

CEPHALIZATION, the tendency exhibited in many different phyla of animals toward the specialization of the region about the mouth into a distinctive head, and the concentration there of nervous and sensory organs. In the chordates we find a clear development starting from the undifferentiated oral region of Amphioxus without any very special differentiation of its central nervous system and sense organs of the most generalized sort. The cyclostomes and fishes form the next stage, in which there is a definite, though small, brain, and the more important of the special senses (those of smell, sight, hearing, equilibrium) are centralized in the head, which acquires a special skeleton, the skull. We finally come to the terrestrial vertebrates, in which all the special senses become located in the head, the lateral-line sense and dermal chemical sense being lost. The increasing size and complexity of the brain is one of the outstanding features of vertebrate evolution. In

the arthropods we find a regular graduation from the equal segments of the chaetopod worms, which are probably not far removed from the primitive arthropod, to the well-defined head of the crayfish or insect, with its specialized eyes, antennae, jaws, and ganglia. The tendency toward cephalization is associated with the fact that the head is often the first part to take shape in the embryo; however, this fact, as exemplified by the trochosphere larva of the annelids, may indicate that the head of certain segmented forms is the true representative of the entire body of their ancestors, and that the formation of the segmented body may be the reminiscence of an ancestral multiplication by budding.

CEPHALOCELE, hernia of the brain. See **ENCEPHALOCELE**.

CEPHALOCHORDA, sĕf-ă-lō-kôr'dă, or **CEPHALOCHORDATA**, sĕf-ă-lō-kôr-dă'tă, a subphylum within the phylum Chordata found to include Amphioxus, the lancelet. Amphioxus was long considered a true vertebrate, but in view of its lacking a skull and a real brain, it was placed in a special division, the Acrania, all other vertebrates constituting the Craniata. Later, recognizing the unique extension of its notochord (q.v.) to the anterior tip of the body, Amphioxus was made the basis of a subphylum named Cephalochorda, the craniates forming a second subphylum Vertebrata. See also **AMPHIOXUS**; **CHORDATA**.

CEPHALONIA, sĕf-ă-lō'nĭ-ă (Gr. ΚΕΦΑΛΛΕΝΙΑ), an island of Greece, the largest of the Ionian Islands, northwest of the Peloponnese, at the entrance of the Gulf of Patras, about 31 miles in length and from 3 to 20 miles in breadth; area, about 289.4 square miles. With the island of Ithaca, Cephalonia forms the Department of Cephalonia, Greece. The coastline is very irregular and deeply marked with indentations, and the surface is rugged and mountainous, rising in Mt. Ainos to a height of 5,315 feet. One of the few rivers is the Rakli; the island is apt to be dry in summers. The principal towns are Argostolion, the capital, Lixourion, and Same. The leading agricultural products are currants (chief export), wine, olive oil, cotton, citrus fruit, and grain. Manufactures are very few.

History.—Cephalonia was an ally of Athens in the Peloponnesian War and later a member of the Aetolian League. It was taken by Rome in 189 B.C. and was held by Byzantium until captured by the Normans of Sicily in the 11th century. It was ruled by several Italian families until it passed to the Turks in 1479 and to Venice in 1499, which held it until the Treaty of Campo Formio (1797) gave it to France. Two years later it was seized by a Russo-Turkish fleet. By the Treaty of Tilsit (1807), Russia restored the island to France and by the Treaty of Paris (1815), a British protectorate was established over the Ionian Islands until they were ceded to Greece in 1864. It was occupied by Italy for a short time during World War II. Pop. (1940) island 57,384.

CEPHALOPODA, sĕf-ă-lōp'ō-dă, a class of mollusks represented by the squid, octopus, cuttlefish, nautilus, argonaut, and the ancient nautiloids and ammonoids. They are bilaterally symmetrical animals with a highly developed head

which is surrounded by a ring of elongated and mobile tentacles. These muscular tentacles are furnished with prehensile suckers which are usually provided with hooks. The head has two large and well-organized eyes, quite similar to vertebrate eyes, having a retina, iris, cornea, vitreous body and, other than nautilus, a lens. In most forms there is a cartilaginous brain case in which are grouped the cerebral, pedal, and visceral ganglia. In addition, there are well-developed hearing and olfactory organs. The mouth is provided with horny, beak-like jaws and a radula. The muscular mantle forms the outer walls of the body and this is unattached near the head so that water can be freely taken into the mantle cavity. The margin of the mantle is then appressed to the head area and the water forcibly ejected outward through a very flexible funnel. In this way, by changing the direction of the funnel opening, the animal can swim backwards or forwards, or quickly alter its course in either direction by the force and direction of the ejected water. Other than nautilus, existing forms have a sac filled with an ink-like fluid which can be expelled through the funnel. This clouds the water which acts as a screen behind which the animal may escape from its enemies. The "foot" of other mollusks has been modified in the cephalopods to form the tentacles and the funnel. The gills are well developed, either as one or two pairs which are situated within the mantle cavity. There are two kinds of hearts in each individual, the systemic and the branchial. The systemic heart consists of two or four (nautilus) auricles which receive the blood from the gills and a median ventricle from which arise the anterior and posterior aortas. At the base of each gill or paired gills there is the branchial heart which receives the blood from the *vena cava* and pumps it into the gills. Neither the branchial hearts nor the ink sac exists in any other class of mollusks. In most Cephalopoda reproduction is carried out by having the sperm lodged in elastic tubes, the spermatophores, which, by an elaborate arrangement, liberate the sperm after copulation. After the development of the spermatophores, these are passed into the funnel and on to one of the tentacles, then termed the hectocotylus, which has become modified for transferring the sperm. During copulation the hectocotylus is placed within the mantle cavity of the female and the sperm is then released by the spermatophores, fertilizing the eggs.

All cephalopods are exclusively marine animals, and, so far as the fossil record indicates, they have always been so. All are predatory, particularly on fish and crustaceans, and in turn are preyed upon by fish and many marine mammals, particularly the sperm whale. Certain species are among the largest invertebrates known. For example, the giant squid, *Architeuthis princeps*, reaches a length of fifty-two feet including the tentacles. Many of the pelagic and deep-sea forms possess luminescent organs. Many species have chromatophores on the surface of the body which are variously colored, and contractile pigment cells. These cells can be expanded or contracted so that only one pigment may be exhibited at a time. Thus there is a moderate but almost instantaneous change of color from dull red to a dull green.

So far as is now known, the embryology of the cephalopods differs from all other mollusks in that they possess a very large yolk sac and have

incomplete segmentation, and this is restricted to one end of the egg. There are no trochophore or veliger larval stages such as exist in all other Mollusca, development is gradual and direct, and the young are essentially similar to the adult. Octopuses and nautilus live mainly on the ocean floor at varying depths, from the intertidal realm out to over 100 fathoms. Squids, cuttlefish, argonauts, and spirula are pelagic, living in the open ocean and many of these exist at great depths. The genus *Eledonella* has been recorded from the depth of 2,900 fathoms or nearly $3\frac{1}{2}$ miles. The internal shells of spirula are frequently cast up on the beaches in considerable numbers, particularly in tropical areas. The shells being septate, and having chambers filled with gas, come to the surface when the animals die. Subject to both wind and current movements, they are carried hundreds of miles and may eventually reach shores far removed from their point of origin. The female paper sailor (paper nautilus) or *Argonauta*, when the breeding season is reached, produces a thin calcareous shell to act as a receptacle for protecting the eggs. It is believed that the shell is cast aside when the breeding season is over. In rather rare instances the shells are turned over and sufficient air is captured in the small spiral portion of the shell to enable it to remain afloat and eventually reach shore, though probably many more sink to the bottom than remain afloat.

The cephalopods are an old and apparently waning group of mollusks. Today some 170 genera and a few more than 400 species remain in our seas. About 600 genera and over 10,000 species of fossil cephalopods have been described, the earliest from the Upper Cambrian rocks. The nautiloids reached their greatest development during the early Paleozoic and the ammonoids reached their peak of development during the Mesozoic. The class Cephalopoda, both fossil and living forms, is divided into three subclasses:

Subclass 1. NAUTILOIDEA. Having straight and coiled chambered shells with slightly curved and transverse septa with the sutures simple. Possibly four gills were present in the fossil species such as now exist in the chambered, or pearly, *Nautilus*, the only living genus in this subclass. The range in time for the Nautiloidea is Upper Cambrian to Recent.

Subclass 2. AMMONOIDEA. Having coiled chambered shells with wrinkled septa, the sutures very complex and the shell with more or less sculptured exteriors. The number of gills present unknown, but possibly four in number. The range in time for the Ammonoidea is Upper Silurian to Upper Cretaceous.

Subclass 3. COLEOIDEA. Having an internal calcareous vestigial shell, or a chitonized rod or "pen," or none at all. There are 8 or 10 tentacles and two gills. To this class belong the squids, cuttlefish, the extinct belemnites, the *Argonauta* and octopuses. The range in time for the Coleoidea is from the Upper Mississippian to Recent.

In older classifications the Nautiloidea and Ammonoidea were grouped together as the subclass Tetrabranchia, and the subclass Coleoidea was called Dibranchia. This classification was based upon the number of gills present, four gills for the Tetrabranchia or two gills for the Dibranchia. However, modern authors, using additional characters rather than the gills alone, have divided the Cephalopoda into three subclasses as given above. The direct economic importance to man of the cephalopods is relatively minor. In many areas, particularly the Mediterranean, Japan, Polynesia, and the East Indies, they form an important item of food. Elsewhere, such as along the North Atlantic states and northern Europe, squids are used ex-

tensively as bait for commercial fishing. *Sepia*, long used as a dark brown pigment for water-color painting, is derived from the "ink" of *sepia*, the common cuttlefish of European waters. The internal shell or cuttlebone from *Sepia* and other allied genera has been a source of soft lime, used as an abrasive in dental work, and directly as a source of lime for caged birds.

WILLIAM CLENCH,
Curator of Mollusks, Museum of Comparative Zoology, Harvard College.

CEPHALUS, sĕf'ā-lūs, an Attic hero who was according to some the son of Deion, king of Phocis, and of Diomedes. He was the husband of Procris. Shortly after his marriage, Eos (Aurora) carried off the beautiful youth while he was hunting on Mount Hymettus. He refused the love of the goddess, who induced him to put the virtue of his wife to a trial which it could not withstand. Procris, in return, tempted him likewise, and he also yielded. Learning their mutual weakness, they became reconciled. But Procris subsequently became jealous of her husband, and concealed herself in a wood to watch him. He mistook her among the leaves for a wild animal, and killed her with a magical spear.

CEPHAS, sĕf'ās, or **KEPHA**, the name given to Simon Peter by Jesus (John 1:42). See also SAINT PETER.

CEPHEUS, sĕf'ūs, king of Ethiopia, husband of Cassiopeia and father of Andromeda. He is commemorated by a northern circumpolar constellation, bounded by Draco, Ursa Minor, Camelopardalis, Cassiopeia, Lacerta, and Cygnus. Its brightest star is Alpha (Alderamin), +2.60 magnitude, but its most famous is Delta which has given its name to the very important class of variables known as Cepheids. See also CASSIOPEIA.

CEPHISODOTUS, sĕf-i-sōd'ō-tūs, the name of two Greek sculptors, related to Praxiteles, who lived in the 4th century B.C. The elder was possibly an older brother of Praxiteles while the younger was his son. The most notable work of the elder was his group of Irene, goddess of peace, holding the infant Plutus, god of wealth. A copy is in Munich. The younger Cephisodotus was chiefly known for his statues of Menander, the writer of comedies, Lycurgus, the orator, and others, none of which remain.

CEPHISUS, sĕ-fi'sūs, or **CEPHISSUS**, the name of three rivers in Greece. (1) A river which rises in Mt. Pentelikon and waters the Athenian plain. It flows 20 miles southwest past Athens to the Bay of Phaleron of Saronic Gulf, east of Piraeus. (2) In Attica, a river of the same name rises in the Patera Mountain and flows 17 miles, east and south, to the Bay of Eleusis of Saronic Gulf. (3) This river, mainly in Boeotia, rises on the northern slopes of Mt. Parnassus and flows 71 miles east-southeast to the Gulf of Euboea, 10 miles west-northwest of Chalcis. In its lower course it forms lakes Hylike and Paralimne.

CERACCHI, chā-rāk'kē, **Giuseppe**, Italian sculptor; b. Rome, Italy, July 4, 1751; d. Paris, France, Jan. 30, 1802. After studying under

Tomaso Righi, he went to London in 1775 where he executed many commissions. In 1789, he went to America where he did portrait busts of George Washington, Benjamin Franklin, and Alexander Hamilton. Upon returning to Europe, while in Milan, he modeled a bust of Napoleon, who invited him to Paris. His republican sympathies induced him to join in a conspiracy against Napoleon. As a consequence, he was arrested and sent to the guillotine along with all but one of his fellow conspirators.

CERAM, sā'rām (also spelled SERAN or SERANG), second largest island in the Molucca Islands, Indonesia, lying between the Ceram Sea on the north and Banda Sea on the south, 100 miles west of New Guinea. The island is 210 miles long, 45 miles wide, and has a mountain range which rises to 10,205 feet in Mt. Binaija. There are several wide bays and the coastal plain is narrow. The principal products are copra, resin, fish, and sago, but rice, maize, sugarcane, spices, coconuts, and fruits are also raised. Hardwoods and other forest products are found in the dense forests here. Some oil has been found near Bula on the northeast coast. The chief port is Wahai on the north coast.

The natives live chiefly along the coast and are Malay mixed with some Papuan stock. A large number are Mohammedans but many Christians live in the west. Portuguese missionaries were here in the 16th century. In the early 17th century trading posts were established by the Dutch. The island came under Dutch control about 1650, where it remained until February 1942, when it was occupied by the Japanese as an airbase. At the end of World War II it was returned to the Dutch.

It is politically administered by the residency of Amboina, of the Moluccas. The Ceram census division includes the islands of Boano, Kelang, Manipa, and the Ceram Laut, Watubela, and Goram groups. The area of this division is 7,191 square miles. Pop. (1930) 100,029.

CERAMBYCIDAE, sĕr-ām-bis'i-dē, a family of beetles of the order Coleoptera commonly known as Longhorns or Longicorns, of which approximately 20,000 kinds have been described. The smallest species are only one fifteenth of an inch long, the largest over six inches. They vary enormously in shape but all are characterized by having long, usually tapering antennae which are often more than twice as long as the body: in the subfamily Prioninae they are usually serrate. The prionines are flattened, with parallel sides or somewhat tapering behind the thorax, and include the largest members of the family. Their strong mouthparts are capable of inflicting severe bites. The adult Cerambycidae are undoubtedly the most varied of all the beetles but the larvae are practically all borers in plants, a very small number living in the nests of ants. The adult habits are as varied as their appearances; some are nocturnal, some fly at dawn or dusk, while others love the brightest sunshine. Most of the diurnal species are brightly colored and many of those that visit flowers in order to feed upon pollen and nectar resemble bees and wasps while flying; others resemble and act like ants. When disturbed many of them are quite sluggish, but others drop instantly from a plant and take flight before reaching the ground: a few of them play possum. Species of *Urochaetes*

of the American tropics resemble bumblebees while the North American species of *Elytroleptus* mimic relatives of the fireflies.

The European musk beetle (*Aromia moschata*), about an inch long and metallic green, coppery and blue, gives off a scent that is said to be like attar of roses. The larvae live in dead willows. Adults in many genera are able to stridulate, and the chewing larvae in dead wood may produce a noise that can be heard several feet away.

Many of the species are pests of forest and cultivated trees and shrubs, although the vast majority attack dying or dead wood. While the larvae normally mature in from one to four years, depending upon the species, there are records of beetles emerging from furniture from 15 to 45 years after it had been manufactured. In such cases it is safe to assume that the curing and varnishing of the wood reduced both the palatability of the food and the amount of air present.

Among the most serious horticultural pests are species belonging to the genus *Oberea*. These are long and cylindrical and the female girdles the twigs of raspberries and related plants before laying an egg; the girdled tip eventually dies and the larva develops to maturity within it, even though it may fall to the ground. The apple-tree borer, *Saperda candida*, is a beautiful species with brown and white stripes on the elytra: originally a pest of hawthorn, it now attacks apples and is known as the round-headed apple-tree borer. Few forest trees escape attack by the Cerambycids. One of the most beautiful is the maple borer, *Glycobius speciosus*, golden yellow and black. Other variegated black and yellow species belong to the genus *Cyllocus*, the larvae of which bore in hickory, ash, elm, and black locust, while the adults visit flowers. Some groups are associated with conifers and may be serious pests in living trees.

CERAMICS. The productions of a potter. The word is derived from the Greek *keramos*, meaning a vessel made of baked clay. The French refer to the art of the potter as *céramique* and the vessels made as *poterie*. All types of earthenware, stoneware, and porcelain are included in the term ceramics. According to present usage, a distinction is made between opaque and translucent wares. All opaque wares, including not only earthenwares such as terra cotta, Italian majolica, French faience, Delft, and Queen's ware, but stoneware such as fine white English salt-glaze, are called pottery and all translucent wares are classed as porcelain.

The porcelains are divided into true or hard and artificial or soft pastes according to the nature of the ingredients and the temperature in the firing. For the true porcelain, a white refractory clay produced from the decay of feldspar and called kaolin or china clay is fused at a high temperature by means of a less decayed feldspathic material called petuntse or china stone. It is glazed with the china stone generally fluxed with lime and potash, producing a white translucent ware with an extremely hard surface which resists a file. The artificial or soft-paste porcelains are imitations of the true porcelain made of various mixtures of ground glass and other substances fused at a low temperature and glazed with lead glazes which are easily marked with a file. Bone ash was a characteristic ingredient of some Eng-

lish soft-paste porcelains in the 18th century. In the 19th century it became the standard ingredient with kaolin and petuntse in hard porcelain which henceforth was called bone porcelain. Parian ware and Carrara Statuary ware, named for the resemblance to white Italian marbles, are other 19th century varieties of porcelain.

The origins of both pottery and porcelain are lost in the past. Scholars believe the latter was evolved slowly in China over a long period, vessels of a porcelaneous nature having been found in Han grave mounds dating around 200 A.D. The introduction of the true Chinese porcelain into Europe in the 16th and 17th centuries stimulated the Western world to great activity in the field of ceramics and led to the improvement of techniques and bodies and the production of many imitative wares. In Italy successful attempts were made to imitate the Chinese porcelain at the end of the 16th century, but it was not until after 1709 when a young alchemist named Johann Friedrich Böttger (Böttcher) working in Saxony, discovered the ingredients of true porcelain, that its manufacture began in any quantity in Europe. The interest in Oriental wares also made itself felt in the refinement of earthenware and stoneware bodies and in their decoration. The tin-enameled wares of Delft, Strasbourg, Marieberg (near Stockholm), Niederwiller, Sceaux, Bristol, and Liverpool; the fine white English salt-glaze, and the cream color or Queen's ware, perfected by Josiah Wedgwood in 1763, all show this influence.

Ceramic techniques include the preparation of the clay; the shaping by hand, on the wheel, in the mold, or by casting; firing which renders it hard according to the intensity and duration of the fire; and the decoration with slip, glazes, pigments, tooling, turning, incising, piercing, printing, and relief work, molded, sprigged, or applied.

Glaze is a glassy coating, either opaque or translucent, colored or uncolored, which renders a surface impervious to liquids. Glazes are named from an ingredient as salt, tin, or lead; from the method of application as liquid, dry, or blown; from the color as green, mirror-black, or yellow; or from effect as shining, opalescent, or crackle when the surface is covered with a network of fine cracks. Painting is done under the glaze, in the glaze, or over the glaze.

As potters of East and West have always surrounded their activities and methods with secrecy, much ceramic history has been based on conjecture. Excavations on ancient sites in China, the Near East, in Egypt, and on the continents of Europe and America together with serious research on the part of many scholars have revolutionized ceramic knowledge in recent years requiring the revision of many books and museum collections. The attention of collectors has been directed to the Chinese tomb wares of the Han Dynasty 202 B.C. to 220 A.D. and the T'ang Dynasty 618-906 A.D.; to the fine stonewares and porcelains of the Sung Dynasty 960-1279 A.D.; to the Gabri ware, excavated chiefly in northern Persia, with graffiato designs of bird, flower, and animal forms; to the 14th century Italian Orvieto ware with linear painted decoration and the oak-leaf pattern majolica; to the Netherlandish majolica; and to many types of English earthen and stonewares. Among the latter should be mentioned the green glazed pieces, many cast in the form of cauliflowers and pineapples, long attribu-

ted to Thomas Whieldon, and the engine-turned red ware, long assigned to the Elers (John Philip and David), both of which are now known to have been made possible by Josiah Wedgwood's inventions of 1759 and 1763; the fine drab and white English salt-glazed ware, including the scratch blue type, no fragment of which was found in excavations on the site of the Elers factory, and which is now known to have been made by the Wedgwoods of Burslem and also during the partnership of Thomas Whieldon with Josiah Wedgwood (1754-1759) along with agate, tortoiseshell, glazed redware, and the shining black glazed pieces with applied vine reliefs formerly assigned only to Jackfield in Shropshire. Even the so-called Isleworth red and cane ware pieces have been traced to Bohemia in the mid-19th century. The study of English porcelains, chiefly by the English Ceramic Circle, has also resulted in discoveries and reattributions.

In America, the discovery by the late Rudolph P. Hommel of the Savannah potter Andrew Duché as a maker of porcelain in 1739 and his probable connection with the introduction of Cherokee clay in England is perhaps the greatest single discovery in regard to ceramics in America in recent years.

CERAMIC INDUSTRY

With the development of modern technology the ceramic industry has come to include the whole field of nonmetallic minerals which are given desired properties by treatment at high temperatures.

Clays and other silicate minerals remain the chief ceramic raw materials, although the oxides of magnesium, aluminum, zirconium, thorium, titanium, boron, and other metals are sometimes used, alone or in combination, with no silica present. All clays consist mainly of hydrous aluminum silicate ($\text{Al}_2\text{O}_3 \cdot 2\text{SiO}_2 \cdot 2\text{H}_2\text{O}$), differing in such factors as the impurities present and the size and shape of particles.

The most characteristic ceramic reaction is the formation of glass within the ceramic body as it is fired, by the fusion of some of the silica with the fluxes present. The fluid glass flows around the undissolved particles of higher-melting materials, forming a glassy matrix which, upon cooling, gives the fired piece its strength and rigidity. The glass formed will at first have the eutectic composition for the melting materials. For example, in a body containing silica (SiO_2) and alumina (Al_2O_3), liquid glass containing 5.5 per cent alumina and 94.5 per cent silica will begin to form at 2820°F. Because of such eutectic points in ceramic compositions, it is possible to fire ceramic ware at temperatures far below the melting points of any of the raw materials used.

Materials which help to form glass at fairly low temperatures are known as fluxes. The most important are sodium, potassium, calcium, and lithium compounds; magnesium oxide in certain proportions with silica is an effective flux.

Raw Materials Preparation.—Ceramic raw materials usually include small amounts of mineral impurities which may have important effects on firing temperatures, color, and other properties of the ware. When necessary, clays and other minerals are purified by washing, air or froth flotation, or magnetic or heavy-media separation, and are ground to carefully controlled degrees of fineness before being added to a batch for the production of ceramic ware.

Methods of Forming.—Ceramic materials which are sufficiently plastic are formed by extrusion, pressing or "jiggering." A jigger is a machine-age adaptation of the potter's wheel, on which thin bats of clay are placed after being extruded in an even column and cut to the desired thickness. The turning wheel is a plaster mold, the shape of the concave side of the piece to be made; a die which shapes the outer side is brought down against the bat as it turns. Hundreds of dozens of pieces of flatware are produced daily in dinnerware plants using automatic jiggers. Unsymmetrical pieces which cannot be jiggered, such as hollowware, sanitaryware, and electrical porcelains are often cast, using a "slip" of clay mixed with water. In 1948 there was devised a method of automatically pressing plastic clay bodies many times faster than casting, and superior to jiggering in some applications. Water from the clay is absorbed by the porous plaster dies used in pressing, and is drawn off by vacuum. The usual drying period is eliminated. Relatively nonplastic bodies whose moisture content is only 5-15 per cent, such as electrical insulators, tile, and pure refractory oxides, are often formed by dry pressing in hydraulic presses under high pressure. Large refractory pieces are often rammed into the mold with a mallet or air hammer.

Brick and tile are molded or cut from an extruded column, as are many types of porcelains. High-speed, automatic presses have long been used for making intricate shapes of electrical porcelain. The highly mechanized methods of making glassware are described in the articles on GLASS-MAKING and GLASS MANUFACTURING IN AMERICA. Porcelain enamel is being applied more and more by spraying, although dipping (slushing) and the dry-process method are still used.

Firing.—The traditional round or beehive periodic kiln for firing ceramic ware is rapidly being replaced by tunnel kilns in the larger ceramic plants. The tunnel kiln has the advantages of continuous operation and closer temperature control, as the ware is pushed through the kiln on cars rolling on a track. Heat and time are not lost in cooling the kiln between firings. Gas is the cheapest and most used fuel, although oil and coal are both important. For smaller kilns and for closely controlled firing, and in enameling ovens, electric heating is often used. Glass is melted in tanks with hundreds of tons capacity, and here too the continuous process has replaced the older methods. Mixed "batch" is fed into the tank at one end, and the melted glass is drawn continuously from the other.

Glass.—Technologically, silicate glasses are the common denominator of most of the ceramic industry, as has been indicated above, and glass is in some ways the most typical ceramic product.

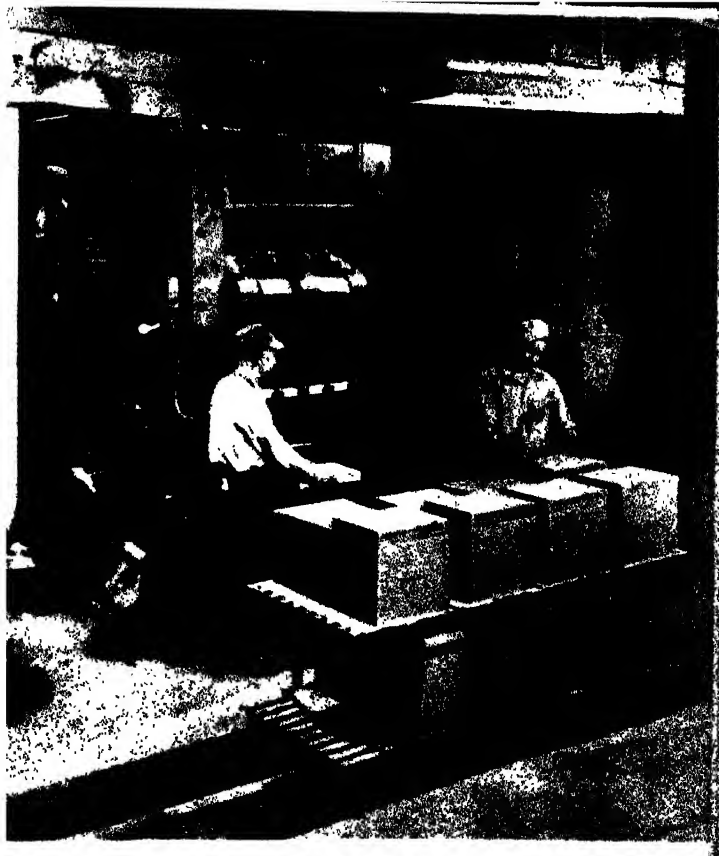
Most commercial glasses contain a large proportion of silica, although there are other metallic oxides which will form useful glasses when fused and allowed to cool. A whole series of glasses, for example, is based on phosphorus pentoxide (P_2O_5) and contains no silica; boric oxide (B_2O_3) is also a good glassformer.

As may be expected from the above comments on eutectics, sodium and calcium oxides melted with silica produce a comparatively low-melting glass. A triple eutectic occurs at the composition 21.3 per cent Na_2O , 5.2 per cent CaO , and 73.5 per cent SiO_2 , with a melting point of about



Above: Plant of one of the major American companies engaged in the manufacture of refractory brick and tile for lining furnaces.

CERAMICS



General Refractories Company

Right: Press used in the manufacture of refractory brick and tile of high density. Many refractory components must be produced with minimum deviation from specified dimensions.



Left: Potter forming a hole in a bushing blank, a step in the manufacture of an important item of electrical equipment.

Above: Turning a transformer bushing on a lathe. This porcelain-type bushing is used at the terminals of the transformer to insulate conductors carrying current between the transformer and transmission lines.

Ewing Galloway

Below: Hauling out "pipe" tiles from the kilns of an Illinois tile company plant.



1340°F. The most ancient man-made glasses are found to have this approximate composition, and about 90 per cent of the glass made today is this soda-lime-silica glass. It has been modified, however, to gain better physical and chemical properties. Using more lime and less soda gives better chemical stability, but increases the tendency of the glass to devitrify (crystallize). This in turn is counteracted by adding small amounts of magnesia, alumina, or boric oxide. Since other oxides may be added as decolorizers, oxidizing agents, and for other effects, the commercial soda-lime glasses of today are quite complex.

Glass with a large proportion of lead oxide was developed in England during the 17th century, and is still widely prized for its clarity. Crystal tableware is lead glass. Since World War I borosilicate glass, containing 12 to 15 per cent of B_2O_3 , has come into wide use because of its great heat-shock resistance, high mechanical strength, and chemical stability. Called Pyrex, it is seen in cookingware, laboratory equipment, glass-lined pipe, and hundreds of other forms.

Whiteware.—Most of the common products known traditionally as ceramics are included in the whiteware group. Pottery and porcelain are described at length in the articles under those headings. It is sufficient to say that pottery, semivitreous ware, and vitreous porcelain or chinaware are basically similar, composed of clay (kaolin and plastic ball clay), flint (ground silica sand), and feldspar ($K_2O \cdot Al_2O_3 \cdot 6SiO_2$ or $Na_2O \cdot Al_2O_3 \cdot 6SiO_2$). They vary through an infinite variety of proportions, with many other minerals used with the above, and particularly they vary in the temperature to which they are fired. The translucency prized in vitreous ware is the result of the formation of a high proportion of glass in firing, which fills all the pores of the fired body. This is not true of the semivitreous bodies, and earthenware is quite porous and will not hold water unless glazed.

Sanitaryware, which includes sinks, lavatories, and similar items, also comes under this category. Dental porcelains, consisting principally of kaolin, quartz, feldspar, and various metallic oxides for coloring, are used for artificial teeth and crowns, and for inlays.

Electrical porcelains are those used for insulators of all kinds. For low-tension circuits, clay-flint-feldspar porcelains similar to those mentioned above are used. For high-frequency use, as in electronic equipment, special compositions made largely of steatite talc (a magnesium silicate) are used, and in certain cases bodies containing titanium and zirconium compounds have advantages. Spark plug insulators, which combine great heat-shock resistance and chemical inertness with very good insulating qualities, are probably the most efficient ceramic insulators yet developed. Shortly before World War II a method of making these insulators from nearly pure alumina (Al_2O_3) was perfected, and they are made in quantities of millions daily. In a unique process the alumina body is mixed with an organic plasticizer and insulator shapes are injection-molded. The plasticizer burns out when they are fired at temperatures of about 3200°F. Synthetic mica ceramics with dielectric properties equal to or better than most other ceramic dielectric insulators have been developed for such applications as general machinable ceramics, electrical insulation, frictional resistant materials, and for radar domes.

Special whiteware products include precision gauges for metal, guides for the textile industry, nozzles for pressure blasting equipment, pressing and extrusion dies, chemical porcelain, heat-resistant thermocouple and pyrometer protection tubes, burner tips and elements for industrial heating equipment, dipping forms for the manufacture of rubber gloves, and similar items. Abrasion and heat resistance plus chemical stability make ceramic products superior to metal in a wide variety of uses.

Porcelain Enamel.—Enamels are complex glasses, designed for a special purpose. They must expand with heat at the same rate as the metal to which they are to be applied, or they will crack and craze on cooling. The basic glass is smelted and quenched by pouring in water; it is ground and then sold as "frit." To the frit are added opacifiers, colorants, and about 15 per cent of plastic clay, which aids in forming the desired thin film on application.

Tin and antimony oxides were for many years the chief opacifiers, and enamels had to be applied in two or three thick coats, burned at 1500° to 1550°F. Since World War II titanium and zirconium oxide opacifiers have made possible much thinner coats with better covering qualities. One thin coat is often used, fired to only 1300°F. on ordinary cold-rolled sheet steel; for the higher temperatures expensive "enameling iron" is needed, as the ordinary types soften and warp. Wide use of enamels in architecture has made this development necessary. The development of an enamel coating for aluminum has increased the use of this material where a lightweight, hard, permanent finish surface is desired for structural and decorative uses. See also ENAMELS AND ENAMELING.

Refractories.—All modern industry is dependent upon refractories to control and contain heat. The steel industry, for example, uses about one dollar's worth of refractories for each ton of steel made.

Fire-clay brick are the most widely used refractories, being used wherever extreme temperatures or chemical action is not present. Various types can be used at temperatures up to from 2900° to 3400°F. Alumina is often added to the clay body for added refractoriness.

Brick of nearly pure silica are used where high compressive strength is needed at high temperatures. Sillimanite and kyanite (both forms of $Al_2O_3 \cdot SiO_2$), sometimes mixed with clay, are used as refractory brick and for other refractory shapes.

Cast blocks and shapes of fused alumina, first produced in the 1930's, soon became standard for glass tanks; cast zircon-alumina blocks are considered superior for some parts of tanks. Magnesia, beryllia, thoria, and lime are used for special refractory purposes. Silicon carbide (Carborundum) refractories are used for kiln furniture, kiln muffles, and other uses where high thermal conductivity and great refractoriness are needed.

Chromite brick contain about 40 per cent chromic oxide, 20 per cent alumina, 25 per cent iron oxide, and some magnesite and silica; magnesite brick are about 88 per cent magnesite. Both types are used to line open-hearth furnaces and in other metal-refining uses.

Carbon and graphite are also used extensively as refractories. The volume stability of carbon makes it less subject to shrinkage than clay re-

fractories for blast furnace hearths. It is also used in certain types of furnaces for melting copper, lead, and aluminum, and in electric furnaces. Graphite, which has high thermal and electrical conductivity, is often preferred to carbon in refractories because it forms a stronger body. Mixed with clay, graphite is widely used for metal-melting crucibles since it provides a reducing atmosphere which prevents oxidation of the metal being melted. It also has nuclear properties which make it valuable in a reactor.

Structural Clay Products.—The making of brick, tile, and related products is one of the oldest of industries and has remained, technologically, one of the most backward. The raw materials used are the more common clays and shales, with sand or lime added. Glazed brick and tile are a higher quality product, and the white floor and wall tile are more nearly a whiteware product. The chief advances in this field in modern times have been in brickmaking machinery and firing methods, not in compositions. (See BRICK; CLAY-WORKING AND BRICK-WORKING MACHINERY.)

Competition from other materials and rising costs have forced the clay products industry into large scale activity in research only since World War II. Lightweight clay products were a primary objective; these are made quite porous and are conveniently used in larger units. Another trend is that toward standardization in the development of modular units of brick and building block. Development of prestressed structural ceramic products has resulted in lighter structures capable of carrying larger loadings. High fuel costs for firing are being cut by finding cheap fluxes to reduce firing temperatures; feldspar and the other common fluxes of the whiteware industry are too expensive for the structural clay field.

Abrasives.—Synthetic abrasives are made of several ceramic products. Boron carbide (B₄C) is the hardest man-made mineral and silicon carbide and fused alumina are extremely hard. These and other abrasive materials are formed into wheels and other shapes by being fired with

small amounts of other ceramic materials or organic resins, which act as a bond.

New Uses of Ceramics.—Ceramic materials can stand up under conditions which no other substances can withstand. Special refractories for use as turbine blades and combustion chamber linings for jet engines were found necessary with the development of this type of engine; other ceramics help to control the heat of atomic fission. Refractory enamels applied a few thousandths of an inch thick make metals able to withstand temperatures hundreds of degrees above their melting points for a short time. A new class of materials called cermets or ceramals consists of metallic and ceramic substances combined in one body, with some of the properties of each.

Professional Organizations.—The American Ceramic Society was founded in 1898 and the British Ceramic Society was founded in 1900. Both have published technical literature continuously since those dates. Other leading technical organizations are the British Society of Glass Technology and the German Ceramic Society. American Ceramic Society publications were circulated in 43 countries in 1950.

The Canadian Ceramic Society was founded in 1902. Publications include: *Journal of the Canadian Ceramic Society* and *The Clay Products News and Ceramic Record*.

Société Française de Céramique was founded in 1947 and is comparable to a specialized research institute. It publishes its own *Bulletin* and contributes to the magazine, *L'Industrie Céramique*.

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HAROLD L. DAKIN.

Revised by STAFF OF THE AMERICAN CERAMIC SOCIETY, INC.

CERARGYRITE. See SILVER—Silver Ores.

CERASTES, sê-rās'têz, the venomous horned vipers of North Africa. There are two species, *Aspis viper* and *Aspis cornuta*, both of which were formerly referred to the genus *Cerastes*, a name now shifted to a group of rear-fanged snakes in Africa. Horned vipers use "side-winding locomotion," a means of progression particularly adaptable for crawling over loose sand. The same method is employed by snakes in other desert regions, notably the American sidewinder or horned rattlesnake (*Crotalus cerastes*). Horned vipers are largely active at night; during the day they bury themselves in the sand, with only the head exposed.

CERATOPSIA. See DINOSAURS—Order *Ornithischia* (Suborder Ceratopsia).

CERATOSAURUS, sêr-â-tô-sô'rûs, a carnivorous dinosaur resembling *Allosaurus* but only reaching a length of about 20 feet. It was of

SELECTED STATISTICS ON THE CHIEF BRANCHES OF THE CERAMIC INDUSTRY

(United States, 1947)

	Employees (approximate)	Value of product shipped (millions of dollars)	Salaries and wages (millions of dollars)
Brick and hollow tile	27,600	\$ 144.5	\$ 69.4
Clay floor and wall tile	6,825	41.0	16.3
Clay sewer pipe	9,100	47.9	22.4
Clay refractories	17,975	109.4	47.1
Non-clay refractories	10,275	90.3	27.8
Earthenware food utensils	16,750	72.0	42.1
Vitreous china food utensils	11,100	43.2	26.8
Vitreous and semivitreous plumbing fixtures*	7,825	68.1	24.6
Other pottery products	9,725	39.9	20.5
China, decorating	1,050	8.4	2.5
Electrical porcelains	11,550	71.5	30.5
Glass containers	47,125	422.6	126.5
Flat glass	27,250	242.8	84.1
Other pressed and blown glass	42,170	234.8	103.8
Porcelain enamel	..	93.4†	..
Totals	246,320	\$1,729.8	\$644.4

* Not including metal fixtures.

† Value of enameled metal used, not the value of appliances and ware as retailed.

bipinnate form, and derives its name from the small horn found on the nasal bone. See also DINOSAURS.

CERAUNIAN MOUNTAINS, sê-rô-ni-ân, a coastal range of southern Albania in the northern Epirus, extending about 70 miles from the Greek border to the Strait of Otranto, where it divides into the Acroceraunian and Lungara ranges. Its highest peak, Mt. Çikë, in the northwest, rises to about 6,727 feet. The name Acroceraunia is sometimes applied to the entire system. See also ACROCERAUNUM.

CERCIS, sûr'sis, a genus of deciduous trees or shrubs of the family Leguminosae and characterized by attractive clusters of pea-like blossoms. *C. canadensis*, the redbud, is a handsome tree with heart-shaped leaves, and is native to most of the eastern United States. In parts of the Central states, wherever it has been able to survive at the edge of a woodland, its great masses of deep rose blossoms, mingled with the white of neighboring dogwood, provide a springtime display that is famous for its beauty. This redbud is often cultivated, and horticultural varieties exist with double or white flowers. Redbud is sometimes called Judas tree, a name better reserved for *C. siliquastrum*, native to southern Europe and Asia, and traditionally associated with the Biblical story of Judas as the tree from which he hanged himself. The western redbud, *C. occidentalis*, is native to California and east to

CERCOPITHECIDAE, sûr-kô-pî-thê'sî-dê, a family within the primate suborder Anthropoidea, which in most taxonomic systems includes all the old world (Asiatic and African) tailed monkeys, but not the anthropoid apes. See also MONKEYS; PRIMATES.

CEREALS. The word cereal is derived from the Cerealia, Roman ceremonies held in honor of Ceres (q.v.), goddess of grain. Cereals are grasses grown for their edible seeds. Botanically, they belong to the family Gramineae. Their seeds are used both for human consumption and livestock feed. They include wheat, oats, barley, rye, rice, proso millet, maize, and grain sorghum. The last two are called row crops as they are usually planted in rows far enough apart to permit intertillage; the others are called small grains.

In some countries pearl millet, teff, and Job's tears are also considered cereals. Only maize originated in America; millet and sorghum are probably indigenous to tropical Africa or Arabia, and the other cereals came from Eurasia.

Growing Conditions.—Physiologically, the small grains are classified as long-day plants with the exception of rice. Rice, maize, sorghum, and millet are short-day plants. All cereals are annuals, but there are winter-annual types of wheat, oats, barley, and rye that are sown in the fall in areas where winters are moderate and summer temperatures and humidity are high. At present, wheat, oats, barley, and rye are grown under relatively cool conditions, wheat being most widely distributed. Oats and barley are grown in the more temperate climates, and winter rye is the hardest of the small grains. Rice, maize, and sorghum are warm-season crops, rice being unique in that it can germinate and thrive in

water. Proso millet is a short-season crop grown on a small acreage in the areas of spring-sown grains in the United States.

The small grains are usually sown in rows six or seven inches apart, although in some areas they are sown broadcast. Maize and sorghum are usually planted in rows that are cultivated primarily for weed control. Large areas of the cereals are sown and harvested with modern machinery designed for maximum efficiency. In the United States and Europe, rapid progress has been made in the control of weeds by spraying with growth-regulating herbicides. Disease and insect problems are being solved in many instances through the development of resistant varieties to which a tremendous amount of effort is devoted throughout the world. Primitive cultural methods are still used, however, in parts of the Orient, India, Africa, and Central America.

The net result of growing cereal crops is a reduction in soil productivity. Depletion of organic matter and nitrogen is especially true of row crops because of the cultivation. Sorghum and millet frequently have a depressing effect on the yield of crops that follow. Where cereals are grown in rotation, grass and legume crops are included and sometimes used as green manures to restore in part the nitrogen, organic matter, and tilth of the soil.

Uses.—Wheat and rice are the dominant cereals used as food. Wheat is the major cereal in the world grain markets. Only wheat and rye can be classified as bread grains. Bread flour is usually made from hard wheats while the best cake and pastry flours are made from soft wheats. Macaroni, spaghetti, noodles, and similar products are made from durum wheat. Only about 14 per cent of the wheat crop in the United States is fed to livestock and poultry on the farm, but byproducts of milling, such as bran, shorts, and middlings, are sold for feed. Black bread from rye flour is common among certain Europeans, but rye bread eaten in the United States is a mixture of rye and wheat flours. Whiskey and alcohol are made from rye, and small amounts of rye are fed to livestock in mixtures with other grains. Wheat is the chief cereal in the national diet of the United States, but rice is the principal food crop for crowded populations of the Orient. Damaged rice and byproducts of milling are fed to livestock.

The major part of the world's barley and oats crops is fed to livestock on the farm. Large quantities of barley are used to produce malt, and the grain is used for human food in parts of Africa, Asia, and Europe. A small percentage of the oats crop is used for food, principally in the form of cooked oatmeal. The bulk of the American corn or maize crop is fed to livestock and poultry, hogs consuming the largest amount. About 10 per cent of the United States crop is used for food and industrial products, such as cornstarch, corn oil, and alcohol. It is the principal food in parts of Mexico and Central America. Millet and sorghum are used almost entirely for feed in the United States, but millet is the chief cereal in parts of Africa, India, the Soviet Union, and China where it is eaten as porridge or ground into flour and made into cakes. The distribution of cereals as flour per person in per cent of total calorie supply in 1951 was: China 73, Asia as a whole 67, Africa 63, Europe 42, South America 39, Oceania 28.5, and United States 25.

World Production.—In 1951, the cereals accounted for 65 per cent of the total production of major crops of the world, excluding the Soviet Union for which there are no reliable statistics, and occupied 73.5 per cent of the total acreage. Wheat was grown on the largest acreage of any crop, the other cereals in the following descending order: rice, maize, millets and sorghum, barley, oats, and rye. Largest in production was rice, a relatively high-yielding crop, followed by wheat, maize, oats, millet and sorghum, barley, and rye.

Since the five-year period of 1934-1938, the most significant changes in cropping and crop production in the world, exclusive of Russia, have been: (1) a marked increase in the acre yield of wheat in North and Central America and a decrease in both acreage and production in South America; (2) a large increase in the production of maize on fewer acres in North and Central America due largely to the use of hybrids, and an increase in acreage and production in Africa; (3) an increase in production of oats in North America largely because of better yields per acre, and a decrease in acreage and production in South America; (4) an increase in acreage and production of barley in North America; (5) a reduction in acreage and production of rye in North America; (6) an increase in acreage and production of sorghum in North and Central America and a decrease in both acreage and production of millet in Europe; and (7) an increase in acreage and production of rice in North and Central America, South America, and Africa.

Those areas of the world that produce more cereals than they consume and export their surplus are the Soviet Union, North and South America, and Oceania. Deficit areas that import cereals are Europe, Asia, and Africa.

The leading areas of production for each cereal crop are indicated in the following table by the percentage of the total world acreage sown in 1951:

	Africa	Asia	Europe	North and Central America
Barley		41	24	19 *
Maize	10	20	13	47
Millet and sorghum	19	61		
Oats			36	55
Rice		93		
Rye			86	
Wheat		38	22	28

* Figure for North America only.

In the United States, maize was grown on the largest acreage followed by wheat, oats, barley, millet and sorghum, rice, and rye. The same order was true for production. In 1951, the United States produced 57 per cent of the world production of maize on 40 per cent of the acreage; 19 per cent of the wheat on 19 per cent of the acreage; 38 per cent of the oats on 41 per cent of the acreage; 11 per cent of the barley on 10 per cent of the acreage; 8 per cent of millet and sorghum on less than 5 per cent of the acreage; 1 per cent of the rice on less than 1 per cent of the acreage; and less than 3 per cent of the rye on 5 per cent of the acreage.

R. S. D.

BREAKFAST CEREALS

The manufacture of modern breakfast cereals began in the late 19th century. Although oatmeal porridge and mush have been eaten since Colo-

nial days, oat cereal became popular only after about 1860 when Ferdinand Schumacher of Akron, Ohio, learned to roll the grains flat instead of grinding them into fine flour. This made it possible to cook them into a less pasty and more appetizing product. Cracked and rolled wheat cereals soon followed.

With the turn of the century "cold" or ready-to-eat cereals were invented, virtually revolutionizing the American breakfast by providing a wide variety of tasty, nourishing cereal products in ready-prepared form.

Wheat flakes and corn flakes were first developed as a health food by Dr. John Harvey Kellogg at the Battle Creek Sanitarium, Battle Creek, Mich., originally established by a group of Seventh-Day Adventists, where a vegetarian diet was part of the treatment. In 1906, a younger brother, Will K. Kellogg, finally incorporated the Battle Creek Toasted Corn Flake Company and, in a few years, many different brands of corn flakes appeared on the market. Charles W. Post, a former patient at the sanitarium, established himself at Battle Creek and began inventing cereal products. His first ready-to-eat cereal was made by baking whole wheat and barley into loaves which were dried and ground into small pieces. The product (Grape Nuts), marketed in 1898, was so successful that it was distributed nationally within a few years. The discovery of Henry Perky of Cambridge, Mass., in the 1890's that boiled whole wheat prescribed for his health could be made more palatable by pressing it into long filaments, led to the product now known as Shredded Wheat. Puffed wheat and puffed rice were developed as the result of experiments on starch grains by the chemist, Dr. Alexander P. Anderson. Heated to about 500°F. in a closed test tube in which the pressure was suddenly released by breaking, the granules exploded and swelled to ten times their original size. By 1904, Dr. Anderson had developed the puffing process for rice and wheat; they were first sold as breakfast cereals in 1904 and 1907 by the Quaker Oats Company.

From these early beginnings, methods have been perfected so that grains can be flaked, rolled, shredded, puffed, baked or ground to yield products which vary in flavor, form, and texture. Through the application of food research, modern processing, packaging, merchandising, and advertising, the manufacture of breakfast cereals has developed into a huge industry in the United States and has spread to other countries. From the outset, the cereal industry has devoted a great deal of attention to packaging to assure maximum protection and freshness of the product. Today, all breakfast cereals which are nationally distributed are packaged. The ready-to-eat varieties are generally sold in moisture-proof packages to preserve crispness. The consumption of breakfast cereals is about 7 pounds per capita, of which the ready-to-eat cereals make up about 65 per cent. Oats, wheat, and corn are the leading grains used by the industry in the order named. The introduction in 1949 of sugar-coated or "presweetened" cereals, as the industry prefers to call them, has become an important factor in the market.

Hot cereals consist of two types: granular products, such as ground whole wheat, farina, and corn meal; and flaked products, such as rolled oats and rolled wheat. Granular whole wheat is made by grinding cleaned, washed wheat be-

ween corrugated rolls and sifting through bolting sieves to yield a product of rather uniform particle size. Granular whole wheat contains all the bran, germ, and endosperm; in making farina, however, the bran and germ are removed.

In the manufacture of rolled oats, selected oats are cleaned, graded according to length, and then dried to facilitate removal of the hulls and to develop flavor. Hulling is accomplished on impact machines which release the oat kernels or groats. After removal of the hulls, the groats are treated with water and steam so that they can be pressed into flakes by the heated flaking rolls with a minimum of shattering. Two types of flakes are produced: those rolled from whole groats (so-called "old-fashioned" rolled oats); and those from groats which have been cut on rotary cutters (so-called "quick" rolled oats).

Ready-to-eat cereal breakfast foods are made in a wide variety but they may be classified into two general types: those made from entire grains or their mill products; and those made from fabricated cereal products. Both of these types are manufactured in the form of flaked, shredded, granular, puffed, and toasted foods. The manufacture of each breakfast cereal requires its own series of milling, flavoring, cooking, flaking, rolling, puffing and drying, or toasting operations.

Flaked cereal products include corn flakes, wheat flakes, bran flakes, and rice flakes. In the manufacture of corn flakes, hominy grits (large fragments of corn endosperm) are mixed with flavoring materials, thoroughly cooked, dried to the desired moisture content, and rolled into flakes between heavy rollers. The flakes are then toasted.

Puffed breakfast cereals include puffed wheat, puffed rice, and puffed products which are fabricated from doughs, such as Kix and Cheerios. The grains or doughs to be puffed are enclosed in a pressure chamber, or puffing gun, and heated. When the desired water vapor pressure has been reached, the gun is allowed to open and the sudden expansion of the water vapor and air results in the explosion or enlargement of the cereal particles.

Adding Vitamins.—The addition of essential B vitamins and minerals to improve the nutritive value of cereal products has been an important development of the 20th century. In refined cereal products from which the bran and germ have been removed the biological value of the protein and the quantities of B-vitamins and minerals are lower than those of the original cereal. The heat processing involved in manufacture destroys part of the thiamine and impairs the nutritive value of the proteins.

Products made from processed cereals are either "restored" or "fortified" by addition of B-vitamins and minerals. For restoration, sufficient amounts of thiamine, niacin and iron are added to attain the natural or whole-grain levels. In fortified products, certain minerals or vitamins are added to give quantities in excess of those found in the original cereals; vitamin D, not normally present in cereals, may be added. Differences in the nutritive value of the proteins of different breakfast cereals, depending upon whether they are made from whole-grain or refined cereals and upon the extent of heat, are obliterated when consumed with equal weights of milk. Breakfast cereals owe much of their prestige to the application of nutritional research findings in their manufacture.

Cereal Coffee Substitutes.—Roasted cereals have long been used as substitutes for coffee. Postum Cereal, which was developed by Charles W. Post in the late 1890's, is a representative product of this type. It is prepared from whole wheat carefully roasted, granulated, and then blended with a similarly roasted mixture of bran and sugarcane molasses. Instant Postum, a soluble vacuum-dried extract of Postum Cereal, was placed on the market in 1912.

Cereal Foods for Babies.—Precooked cereal foods in dry form for use in infant feeding are manufactured on a large scale. These preparations require only the addition of milk for feeding and are so compounded as to provide an excellent source of high quality protein and of essential B-vitamins and minerals. In addition to one or more cereal products, they contain such ingredients as powdered beef bone, dried yeast, salt, sodium iron pyrophosphate, thiamine nitrate, riboflavin, and niacin in such proportions as to provide food which will contain desirable quantities of the essential B-vitamins and minerals. In some of these infant foods, the refined cereal component is obtained from a single grain such as wheat, barley, oats, rice, or corn; a preparation is also made in which a mixture of cereal flours is employed. The cereals are carefully refined to remove the bran and germ, yielding a product of low fiber and fat content which will have little tendency to become rancid.

The ingredients are mixed with hot water and fed to drum dryers which consist of two large heated cylinders that revolve in opposite directions. The mixture is cooked in the space between the drums and, as they turn, they pick up and dry a film of the cereal on their surfaces. The dried material is shaved from the rolls in a continuous sheet by knives and passed through flaking machines. It is usually then toasted to produce the desired moisture, color and flavor, allowed to cool, and packaged. See also **BARLEY**; **BUCKWHEAT**; **GRAINS**; **GRAIN ELEVATOR**; **GRASSES IN THE UNITED STATES**; **CORN—Indian Corn**; **MILLET**; **OATS**; **RICE**; **RYE**; **SORGHUM**; **WHEAT**; **AGRICULTURE IN THE UNITED STATES**.

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W. F. G.

Authors of Sections:

(R.S.D.) R. S. DUNHAM,
Department of Agronomy and Plant Genetics,
University of Minnesota.

(W.F.G.) W. F. GEDDES,
Professor of Agricultural Chemistry, University
of Minnesota.

CEREBELLUM. See **BRAIN, ANATOMY OF**;
BRAIN, TUMORS OF THE—Cerebellum.

CEREBRAL HEMORRHAGE. See
APOPLEXY.

CEREBRAL PALSY (also known as **SPASTIC PARALYSIS**, **CEREBROSPASTIC PARALYSIS**, **LITTLE'S DISEASE**, and **INFANTILE CEREBRAL PALSY**) is a condition characterized by paralysis, weakness, incoordination, involuntary motion, or any other aberration of motor function caused by brain injury. The injury to the brain occurs most commonly at the time of birth, and may be the result

of head trauma during the birth process, or of interference with the oxygen supply to the brain. It occurs more commonly, therefore, when labor is difficult or abnormal, or when the child is weak or debilitated, as in prematurity. Less frequently, damage to the fetal brain can occur even before birth as an effect of disease of the mother or involvement of the placenta. Incompatibility of blood types of the mother and baby (the Rh factor) is a cause of cerebral palsy. Occa-

cause cerebral palsy. The incidence of the condition is about one in 250 live births.

Cerebral palsy occurring in infancy or early childhood, before full growth and development have been attained, generally causes more profound and irreversible handicaps than when it occurs in adults, as from strokes, or in older children after full intellect, speech, hand skills, and locomotion have been achieved.

The degree of disability is dependent upon the site and amount of damage in the brain. Sometimes, damage is so slight that the individual may have only a mild clumsiness or incoordination of the hands, or a slight loss of balance in walking, or a minor speech impediment. In very severe cases, the individual may be confined to wheelchair or bed and be totally dependent upon others. At times, speech may be so involved that verbal communication is impossible. In some patients, only the right or left half of the body is affected. In others, both legs may be involved, so that walking is associated with a waddle and the typical "scissors gait," with one leg crossing over the other. Complete loss of hand function might make it impossible for one to give himself any degree of self care. In some individuals drooling and grimacing motions of the face, flailing motions of the arms, and unsteadiness in gait, may result in a rather unprepossessing appearance.

Because the brain controls so many functions other than purely motor acts, it is common to have other defects associated with cerebral palsy. Thus, defective vision or hearing, convulsive tendencies, intellectual impairment, and personality changes may occur in cerebral palsy. These associated defects may in some instances be more disabling than the motor disability by itself.

For many years, it was thought that all children with cerebral palsy were hopeless crippled idiots who would never walk or help themselves. Advances in the field of rehabilitation and in evaluation of the true mental status of the cerebral palsied indicate that over 50 per cent of them can be rehabilitated and many of these can profit from an educational program.

M. A. PERLSTEIN.

CEREBRON, sĕr'ĕ-brŏn, or **PHRENOSIN**, one of the three major cerebroside, found in the brain tissues and to a lesser degree in the nervous system. It has the empirical formula $C_{17}H_{35}NO_8$, and contains the fatty acid cerebronic acid, $C_{18}H_{35}O_8$. It is manufactured by mixing macerated ox brain with acetone, allowing to stand for 48 hours, filtering, and repeating the process. The residue, cleaned of impurities, is dried and extracted extensively with petroleum ether. The cake residue is then ground to a fine powder and the phosphatides are removed by extraction with alcohol in which cerebrin is soluble. Upon hydrolysis, using dilute acids, cerebrin is converted

into a monosaccharide, the fatty acid galactose, and a nitrogenous substance known as sphingosin, $C_{17}H_{35}NO_8$, which can reduce Fehling's solution.

CEREBROSIDES, sĕr'ĕ-brŏ-sids, a class of substances resembling in appearance the solid fats, such as tallow, which are found in nerve and brain tissue, egg yolk, and the spleen. They belong to the general class of natural products known as lipids (see BIOCHEMISTRY). An idea

of these substances are broken up by the action of chemicals with the addition of hydrogen and hydroxyl groups, the simpler substances which result include: the sugar, galactose, which has the same composition and slightly different structure from glucose, $C_6H_{12}O_6$; alcohols containing an amino group, NH_2 ; fatty acids; and choline, which has the formula $(CH_3)_3N(OH)CH_2CH_2OH$. Some of these materials also contain phosphoric acid, H_3PO_4 , in combination.

W. T. READ.

CEREBROSPINAL FLUID. See BRAIN, ANATOMY OF.

CEREBROSPINAL MENINGITIS. See MENINGITIS.

CEREBRUM. See BRAIN, ANATOMY OF.

CEREMONIAL, Court. See COURT CEREMONIAL.

CEREMONIALE, a liturgical book of the Catholic Church containing directions or formularies, or both, for the celebration of public services and the administration of sacraments. Such books date from about the 16th century, being successors of the old *Ordines* and the *Rituales libri*, or *Libri agendarum*. Various churches and religious orders had, or have, their own ceremonials.

Caeremoniale Romanum, or *Rituum Ecclesiasticorum sive Sacrarum Caeremoniarum Sanctae Ecclesiae Romanae libri tres non ante impressi*, was compiled about 1488 by Augustinus Patricius, or Patrizi, but was first published in 1516 at Venice under the name of Christophorus Marcellus. It comprises ceremonies which are papal in character, and copies of it are scarce; there is a fine two-volume edition with extensive commentaries by Joseph Catalani, published at Rome in 1750.

Caeremoniale Episcoporum, published by Pope Clement VIII in 1600 and revised in 1650, 1721, and 1741, has the force of liturgical law throughout the church. It contains directions, or rubrics, for Mass, Vespers, and other services. Conceived with cathedral or collegiate churches in view, it applies, with the necessary modification, to all Catholic churches.

ALASTAIR GUINAN.

CERES, sĕr'ĕz, in Roman mythology, the name of an Italic goddess identified with Demeter (q.v.), when the latter's cult was introduced into Italy. The origin of her name, which is not Latin, is uncertain. Some think it Oscan; others consider it Etruscan, for Ceres (so Servius says) was one of the Etruscan Penates; others suggest that Ceres may be equated with the Greek Kore (that

"maiden"), another name for Persephone, the daughter of Demeter, with whom Demeter herself was often confounded. The worship of Demeter, or Ceres, was introduced into Rome from Sicily at the beginning of the 5th century B.C., and the first temple to her was vowed by the dictator, A. Postumius Albinus, 496 B.C. Her worship soon acquired a considerable degree of political importance. She was the goddess of the earth in its capacity of bringing forth fruits and grain. Her festival was the Cerealia (Cerialia), celebrated April 19. She is always represented as fully draped, with ears of corn and poppies in her hands and on her head a corn-measure. They sacrificed pigs and cows to her. As usual when the Romans introduced the worship of a foreign divinity into their own city, they adopted all the legends connected with that divinity, adapting them to their own mythology. Thus she was made the daughter of Saturn and Ops, and sister of Juno, Pluto, Neptune, Jupiter and Vesta. Her daughter was Persephone (q.v.). See also ROMAN RELIGION.

CERES, the name of the first asteroid discovered between the orbits of Mars and Jupiter. It was discovered by Giuseppi Piazzi, Jan. 1, 1801. Having observed it at Palermo, in Sicily, he called it Ceres, after the old tutelary divinity of that island. Under favorable circumstances it has been seen by the naked eye as a star of the seventh magnitude, but more generally it looks like one of the eighth magnitude; some observers call the light reddish and perceive a haze about the planet. Its diameter is about 500 miles.

CEREUS, sê-rê-ûs, a genus of plants of the family Cactaceae, remarkable for their singularity of form and the beauty of the flowers. *C. giganteus*, the suwarrow or saguaro of the Mexicans, is perhaps the largest and most striking of the genus. It rises to the height of 50 or 60 feet, and looks more like a candelabrum than a tree of the normal type. It occurs in Arizona and northwestern Mexico. Other notable species are *C. senilis*, the long gray bristles of which give it the appearance of the head of an old gray-haired man. *C. grandiflorus* is the night-flowering cereus, but there are others which also flower at night. *C. speciosus*, an erect plant, commonly cultivated in greenhouses, is a native of Mexico. *C. flagelliformis*, a creeper, is not unfrequently met with in gardens. The members of the genus are generally useful as cardiac agents and antipyretics. The fruits of many species are used for food.

CERIGNOLA, châ-rê-nyô'lâ, town, Italy, in the province of Foggia, 22 miles southeast from the city of Foggia. It has a college, several convents, and a hospital. The inhabitants manufacture linen; the district produces large quantities of almonds, oil, and cotton. In 1503 the Spaniards under their *Gran Capitán*, Gonzalo Fernández de Córdoba, defeated the French commanded by Louis d'Armagnac, duke of Nemours, who was slain. Pop. (1951) 51,268.

CERIGO, châ-rê-gô, (ancient CYTHERA), Island, Greece, in the Mediterranean, separated from the southern coast of the Morea by a narrow strait. It formerly belonged to the Ionian Republic of the Seven Islands, but in 1864 became part of the province of Arcadia, Greece;

area, 110 square miles. It is rather rocky and mountainous. Grain, wine, olives, and other fruits are raised. Sheep and goats constitute the chief live stock. The people are of Greek origin, and are all of the Greek Church. At an early period a Phoenician colony was founded here. Later it was successively under the control of Argos, Sparta, and Athens, and finally fell into the hands of the Romans. After submitting to Venice and then to Turkey, in 1718, it was once more assigned to Venice. It was annexed to France in 1807; two years later it was occupied by the English; after 1815 it shared the fate of the Ionian Islands. It was anciently sacred to Aphrodite (Venus), who was also called Cytherea. Pop. 9,092.

CERINTHUS, sê-rin'thûs, one of the first heresiarchs who, according to Saint Irenaeus in his work, *Against Heresies*, was contemporary with the evangelist Saint John; but Tertullian and Epiphanius refer him to the time of Hadrian. In Irenaeus' work, as also in the *Philosophumena*, attributed variously to Origen and Hippolytus, bishop of Ostia, Cerinthus is represented as an alumnus of the pagan philosophical schools of Alexandria; but he broached his heretical doctrines in Asia Minor, and there had a numerous following. The universe, he taught, is not the work of the First God, but was created by some angelic power far inferior to the supreme power. Jesus he held to be the son of Joseph and Mary, born as other men are born, but excelling all in righteousness, wisdom, and understanding. Cerinthus taught also that upon Jesus, after his baptism of John, descended the Christos from the power which is supreme over all, in the form of a dove, and that then Jesus proclaimed the unknown Father and wrought miracles; but that at the end of the passion the Christos flew away out of Jesus, and Jesus suffered, but that the Christos remained impassible, being the spirit (or breath) of God. Angels play a conspicuous part in the system of Cerinthus. Thus it was an angel, he says, that gave the law to Moses; and the Yahve of Israel was an angel. Cerinthus and his followers entertained a special animosity against Saint Paul and Saint John, and the heresiarch is credited with writing an apocalyptic book in rivalry with Saint John. He is said to have been a believer in the millennial reign of the Christ upon the earth. Modern critics consider Cerinthus a Gnostic who, in common with the Jewish Ebionites, held the belief that the Christ was a thing apart, which was with Jesus only during his life and left him at death.

CERITE, sê-rî't, a mineral occurring only at Bastnäs Västmanland, in Sweden, and containing the rare element cerium, and others of the cerium group. Its formula is not certainly known, but the mineral may be described as a silicate of the metals of the cerium group, combined with small quantities of calcium and iron. It is mostly massive or granular, but crystals belonging to the orthorhombic system are sometimes found. Cerite has a hardness of about 5.5, and a specific gravity of about 4.9. It has a peculiar and characteristic color, intermediate between clove-brown and cherry red shading off to a gray.

CERIUM, sê-rî-ûm, a metallic element be-

longing to the "rare earth" or "lanthanide series." These elements are all alike in that their two outer electron shells are the same. The atomic number of cerium is 58 and its atomic weight 140.13. Its density is 6.92, melting point 640°C., and boiling point 1400°C. Cerium was discovered independently in 1803 by Martin Heinrich Klaproth, and by Jöns Jakob Berzelius, and Wilhelm Hisinger, and was named for the then new planet Ceres. Its common oxides are Ce_2O_3 and CeO_2 , and there are both cerous and ceric salts. Cerium is the twenty-fifth in order of the abundance of the elements. It occurs along with others of the same series and is very hard to separate from them. Its chief sources are monazite sand and bastnaesite. The metal is obtained by electrolysis of its chloride, but most commonly as an alloy called "mischmetal" in which it is the chief ingredient along with other lanthanide metals. Cerium is rarely used alone, but is a minor but extremely effective ingredient of many useful substances. Cerium sulphate is a valuable analytical reagent. Only the oxalate is used in medicine. Cerium oxide is a strategic material because of its clean and efficient action in polishing optical glass. Cerium oxide adds heat resistance to glass, acts as an opacifier in enamels, and renders Seger cones luminescent. It adds to the brightness of arc carbons, and its aluminum silicate is a phosphor in fluorescent lamps. A small amount of cerium is necessary in the infrared detecting device, the metascope. Cerium oxide to the extent of only 1 per cent made the thorium of the now nearly obsolete gas mantle incandescent, but a more modern use is as an ingredient, the pyrophoric iron alloy in lighter flints. Cerium is in the electrodes of certain photoelectric cells. The metal really comes into its own in the alloy field. Added to hypereutectic cast iron it makes the graphite form in nodules with great improvement in the product. Cerium is in many stainless and tool steels. Magnesium alloys containing cerium along with zirconium or manganese have excellent high temperature properties. Cerium has a markedly beneficial effect on aluminum alloys when no more than 1 per cent is present.

CERNAUTI, chër-nà-ōōts'; -ōō'tsë, city, Soviet Union, principal city of Bukovina, Ukrainian Soviet Socialist Republic, on the right bank of the Prut, 164 miles southeast of Lvov; the German name was CZERNOWITZ. It possesses a notable university, founded in 1875, an industrial museum, and botanical garden. During the 19th century Cernauti expanded from an insignificant village into an important commercial and industrial center. Occupied by the Austrians in 1775, it passed under Rumanian sovereignty after World War I; following World War II it was ceded to Russia. Pop. (1939 est.) 109,698.

CERNUSCHI, châr-nōōs'kê, **Enrico**, Italian economist: b. Milan, 1821; d. Menton, France, May 12, 1896. He graduated at Pavia in 1842, and soon thereafter began to take a prominent part in radical political movements. Involved in the nationalist insurrections in Milan in 1848 and Rome the next year, he sought refuge in France in 1850. Settling in Paris, he acquired a large fortune as a banker and became a director of the Bank of Paris. In *Le Siècle*, of which he was principal owner, he denounced socialism so violently that he aroused the antagonism of the Commune and was compelled to leave the coun-

try in 1871. For several years he traveled widely visiting the Orient and, in 1877, the United States. He bequeathed his valuable ethnological and art collections to the city of Paris, where they were housed in the Musée Cernuschi, opened in 1898. He was an ardent advocate of bimetalism, the term for which he is said to have coined expounding his views on the subject in *Silver Vindicated* (1876). Other works included *Mécanique de l'échange* (1865); *Le bi-metallisme à quinze et demi* (1881); *Le Grand Procès de l'Union latine* (1884); *Illusions des sociétés coopératives* (1866); *Anatomie de la monnaie* (1886).

CERO, sê'rô, a large, edible fish (*Scomberomorus regale*) of the western Atlantic, and similar to the Spanish mackerel. Another species (*S. cavalla*), also called "sierra" or "king cero" is found in the southern Atlantic, and reaches double the weight of the former, often attaining 100 pounds.

CEROGRAPHY, sê-rôg'rá-fë, the art of making designs or drawings in or by means of wax, as practiced by the ancients. The art of painting in wax is known as encaustic painting (see MURAL PAINTING). The word comes from the Greek *kêros*, wax; *graphein*, to write.

CERRE, sê-râ', **Jean Gabriel**, Canadian-American fur trader: b. Montreal, Aug. 12, 1734; d. St. Louis, Mo. (?), April 4, 1805. One of the wealthiest men of his time in the West, he had a trading post at Kaskaskia, Ill., when George Rogers Clark captured it from the British in 1778, and was persuaded to provide money and provisions for Clark's men. Cerré later moved to St. Louis, and in 1780 established one of his many trading posts at what became New Madrid, Mo.

CERRO DE PASCO, sêr'rô thâ päs'cô, town, Peru, situated about 112 miles northeast of Lima, with which it is connected by road and the highest railroad in the world. It is the capital of Pasco Department, and from 1851 to 1931, when it was replaced by Huancayo, was the capital of Junin Department, out of part of which Pasco Department was created in 1944. One of the most famous mining centers in the world, Cerro de Pasco was founded in 1771 in a cold, desolate region of the Andes at an altitude of 14,208 feet. It is accordingly one of the highest inhabited places in the world; the labor for the mines must be supplied exclusively by Indians accustomed to the rarified atmosphere.

According to tradition, silver was discovered here in 1630, and until the decline in silver production late in the 19th century, its mines were second in South America only to Potosi in Bolivia. Copper succeeded silver, and Cerro de Pasco produces nearly all of that metal mined in Peru; the chief producer being the Cerro de Pasco Copper Corporation. Considerable quantities of gold, lead, zinc, and bismuth are also mined, and Mina Ragra nearby, owned by the Vanadium Corporation of America, accounts for some 80 per cent of the world's vanadium. There is a lead refinery and a copper smelter at La Oroya along the railroad to Lima. This railroad (Lima to La Oroya), a magnificent feat of engineering containing no less than 67 tunnels,

was constructed by Henry Meiggs (1811-1877), while he was a fugitive from justice in the United States. Meiggs' funds were exhausted, however, before he could bring the line to Cerro de Pasco.

CERRO GORDO, sĕr'ró gôr'thò, **Battle of**, one of the sharpest engagements of the Mexican War, fought April 18, 1847 for possession of the mountain pass called Cerro Gordo ("fat hill") between the port of Veracruz and Jalapa (or Xalapa). After the capture of Veracruz the American commander, Gen. Winfield Scott, moved his troops northwest along the National Road toward Mexico City. Some 50 miles from Veracruz this leaves the warm, humid lowlands and climbs an eastern spur of the central plateau of Mexico, seamed with ravines and thick with chaparral, and pierced by the defile of the little Río del Plan. To this defile the road, after crossing it and leaving it by a loop to the north among the mountains, returns at a ravine separating a sharp, rocky ridge called Atalaya from a conical eminence called Telegraph Hill (El Telégrafo). West of this again is the small hamlet called Cerro Gordo. On April 9, Antonio López de Santa Anna, the Mexican commander, began fortifying Telegraph Hill, and from the 12th pushed on the work with all his force; accumulating about 12,000 men, the bulk at Cerro Gordo, but neglecting to occupy Atalaya. On the 11th, Scott's vanguard came up to Río del Plan, at the foot of the plateau, and by the 17th most of his forces had arrived there. Troops under Brig. Gen. David Emanuel Twiggs occupied Atalaya, then undefended, just as a Mexican detachment advanced to do so, routed them and chased them in headlong flight half way up Telegraph Hill. The whole United States army, about 8,500, being now at hand, Scott issued orders for a general advance next day. Santa Anna's line extended from Telegraph Hill to a road at the ravine, and eastward for a mile along the heights overlooking the National Road, which ends in a precipitous rocky bluff 100 feet high; then back over three ridges terminating in rocky knolls, to the river defile. In front of the batteries and infantry, the chaparral had been cut down and piled into an abattis for several hundred feet. The Americans, on the other hand, planted powerful batteries on Atalaya, and enfiladed the Mexican right with a howitzer across the river. Scott's plan was simple, but brilliantly effective, though the impassable ground made it fall short of the full intention. Since the Mexicans expected the chief attack on their right, he resolved to make only a feint there and assuming that they expected him to move forward along the road, resolved not to do so. In the meantime he ordered the roads cleared around the hills to the north in order that by making a circuit to the National Road in the rear of the Mexicans he might cut off their retreat. On the morning of the 18th Gen. Gideon Johnson Pillow assailed the right; the artillery on Atalaya rained shot and shell with terrific effect on Telegraph Hill, the road batteries, Santa Anna's camp, and even his reserves, and the howitzer over the river added its discharge. Twiggs, Brig. Gen. James Shields and Maj. Gen. William Jenkins Worth, with Col. Bennet Riley, then moved along the circuit until they were on the north flank of Telegraph Hill, at first out of sight, then in full range of the Mexican fire. Santa Anna detached part of the

forces on Telegraph Hill to drive them back; then Harney from Atalaya swept over the crest and down the side, up Telegraph Hill until within 200 feet of the batteries and below their range. There he reformed and in one final charge utterly routed the Mexicans, at the same time turning the forces on the hill against the main body of Mexicans at Cerro Gordo. The entire right, its retreat cut off, threw down its arms and surrendered. The main body broke up in a panic, as the fugitives from Telegraph Hill rushed among them and the guns from that quarter cut them down, and fled wildly down the craggy slopes and to the defile, and westward along the road. The Mexicans lost 1,000 or 1,200 in killed and wounded; about 3,000 prisoners, including 5 generals, and 299 other officers; 43 guns and 3,500 small arms. The Americans lost 63 killed and 368 wounded. The victory laid open the road nearly to the Mexican capital.

CERRO LARGO, sĕr'ró lăr'gò, **department**, Uruguay, in the northeast of the republic. It is well watered, with large savannahs and forests. The inhabitants are chiefly engaged in raising cattle, wheat and other grains. The capital is Melo. Area 5,764 square miles; pop. (1950 est.) 97,256.

CERTALDO, châr-tâl'dò, **commune**, Italy, in Firenze (Florence) Province, Tuscany. It is situated partly on a height, and partly on a flat along the right bank of the Elsa, 18 miles southwest of Florence. The town is an agricultural center, marketing wines and oil; and has a medieval castle rebuilt in the 15th century. It came under Florentine influence in 1198, and was ruled by that city during and after the 13th century. Another building of interest is the Boccaccio House, with a small museum; Giovanni Boccaccio having lived in Certaldo toward the end of his life. Pop. (1940) 12,094.

CERTIORARI, sŭr-shĭ-ô-râ'ri, **in law**, a writ issuing from a superior court to call up the record of a proceeding in an inferior court, or before a body or officer exercising judicial power, that it may be tried or reviewed in the superior court. This writ is usually obtained on complaint of a party that he has not received justice, or that he cannot have an impartial trial in the inferior court or body. It is now largely superseded by the appeal.

CERULEUM, sĕ-rōō'lĕ-ŭm, or **CERULEAN**, sĕ-rōō'lĕ-ăn, a light greenish-blue pigment, in chemical essence a cobaltous stannate. It is both stable and light-fast, and is made by precipitating cobaltous chloride with potassium stannate and heating with a mixture of silica and calcium sulphate.

CERULLI, châr-rōō'lĕ, **Vincenzo**, Italian astronomer: b. Teramo, Abruzzi e Molise, April 20, 1859; d. Merate, Lombardy, May 30, 1927. He was educated at Rome and the observatories of Bonn and Berlin, and for a time was astronomer at the Gregorian University in Rome. In 1892 he founded the observatory at Collurania, near Teramo, of which he became director. He was especially known for his work on Mars and Venus, and his discovery of the planetoid (704) Interamnia. He was a corresponding member of important scientific academies and of

the Italian Astronomical Society. He was the author of two works on Mars and three volumes of publications of the Collurania Observatory, and was a contributor to *Astronomische Nachrichten*.

CERUMINOUS GLANDS, sê-rōō'mī-nūs, the glands of the passageway of the external ear. They secrete cerumen, or earwax, which lubricates the passage to the eardrum. The secretion is extremely bitter and is of a yellowish-brown color. The wax is insect repellent and prevents gnats and other small insects from entering the ear. Occasionally the wax hardens within the passage and becomes attached to the drum itself so that a temporary deafness is produced. This is easily overcome by cleansing the ear passage with a pressure syringe. It is inadvisable for a person to remove the wax himself by means of ear spoons or other instruments, since injury to the drum membrane may result.

HAROLD WELLINGTON JONES, M.D.

CERUSSITE, sêr'ū-sīt, a native lead carbonate, $PbCO_3$. The crystals are orthorhombic, usually in stellate twins, but it is also found in massive, earthy, and stalactitic forms. It is very brittle, has a hardness of 3 to 3.5, and a specific gravity of 6.5. It is translucent, with an adamantine luster. The usual color is white or light gray, but inclusions may make it black, green, or blue. Common as an alteration product of galena, it is an important ore of lead, and frequently contains silver. Fine crystals have been found at Phoenixville, Pa. It is mined in Colorado, Idaho, Arizona, and Utah. Other important localities are Ems, Germany; Sardinia; Spain; Tsumeb, Southwest Africa; and Broken Hill, New South Wales.

CERUTTI, chā-rōō'tē, **Giuseppe Antonio Gioacchino**, French Jesuit theologian: b. Turin, Italy, June 13, 1738; d. Paris, France, Feb. 3, 1792. He was one of the most eminent professors in the Jesuit college at Lyon and his *Apologie de l'institut et de la doctrine des Jesuites* (1762) attracted much attention. He had already published two discourses upon the means of preventing duels, and on the reasons why modern republics have not reached the splendor of the ancient.

He was at Paris in 1789 when the Revolution broke out. Abandoning his former principles, he became one of the most zealous supporters of the new order of things. He was intimately connected with Mirabeau, and labored much for him. He also published with two others a paper called *La Feuille villageoise* for the purpose of keeping villagers informed of the news of the day, and several pamphlets, among them *Mémoire pour le peuple français*. In 1791 he was a member of the legislative assembly. Some time after, he delivered in the church of Saint-Eustache a funeral oration upon Mirabeau.

CERVANTES, sêr-vān'tās, municipality, Philippine Islands, in the eastern part of Ilocos Sur Province in northwestern Luzon. It is on the left bank of the Abra River. Pop. (1948) 4,346.

CERVANTES SAAVEDRA, thêr-vān'tās sâ-ā-vā'thrā, **Miguel de**, Spanish novelist, playwright, and poet: b. Alcalá de Henares, Spain, 1547; d. Madrid, April 23, 1616. He was the fourth child of seven in the family of a deaf,

impoverished surgeon, Rodrigo de Cervantes, whose poverty forced him to move around from town to town. When scarcely seven, Cervantes was in Madrid studying under the humanist Juan López de Hoyos, who encouraged him to write poetry. After 1569 he traveled widely in Italy as valet of Giulio Acquaviva, the brilliantly educated cardinal, in whose company he learned more than in any university. After a while Cervantes enlisted as a soldier in the forces of Diego de Urbina, and on Oct. 7, 1571, took part in the naval Battle of Lepanto. Despite a high fever, he fought as doughtily as any of the men in his galley, the *Marquesa*, and was thrice hit by harquebus shots, one of which permanently maimed his left hand. On recovering from his wounds, he continued his heroic exploits in Lope de Figueroa's battalion at Navarino, Tunis, and La Goleta. He returned to Naples and was granted leave, sailing for home on Sept. 20, 1575 with important letters—one from Prince John of Austria to Philip II—attesting to his valor and gallantry. However, the galley *Sol* in which he was traveling was captured by pirates, and he was taken to Algiers where he remained for five torturous years of slavery and imprisonment. However, during this period he had opportunity to compose some verses. On four occasions he tried to escape, once inciting his



Miguel de Cervantes Saavedra

fellow Christian captives to rebellion. He was finally ransomed by the Trinitarians Fray Juan Gil and Fray Antón de la Bella in September 1580. Little is known of his years in Spain immediately after his homecoming except that in 1585 appeared Part 1 of *La Galatea*, a pastoral novel which, despite his repeated promises, was never completed. As a work of prose fiction it is, like the Italian and Italianate models he was imitating, elegant, highly artificial, and very much a *roman à clef*. He also composed several plays, visited Portugal and Oran (1581) on short missions, and had an affair with a certain Ana Franca de Rojas, who bore him a daughter, Isabel.

In 1584 Cervantes had married Catalina de Palacios Salazar y Vozmediano, a member of an ancient but impoverished family. Compelled to look for lucrative activity, he tried his hand at writing for the stage. To this period may be ascribed *El trato de Argel* and the powerful tragedy *La Numancia*. In 1587 he began his trying journeys as tax collector through Andalusia and La Mancha, gathering oil and grains for the Invincible Armada. On one occasion he was excommunicated for appropriating grain belonging to the Cabildo of Sevilla; on another, a Portuguese banker, Simón Freire de Lima, went bankrupt and lost a considerable sum for which Cervantes was held responsible. Twice he found him-

self in a Sevillian jail—in 1597 and again in 1602. Perhaps during these periods of relative quiet he came upon and gestated the idea of *Don Quixote* (*Don Quijote de la Mancha*).

At the beginning of the 17th century, when Philip III moved his court to the city of Valladolid, Cervantes was living there with his sisters Andrea and Magdalene, his illegitimate daughter Isabel Saavedra, and his niece Constanza de Ovando. On June 27, 1605, a gentleman named Gaspar de Ezpeleta was wounded in front of their house and died without revealing his killer. The Cervantes family was thrown into jail, but soon released when nothing could be proved against them.

Part 1 of *Don Quixote* appeared in 1605, and Part 2 in 1615; *Novelas ejemplares* (*Cautionary Tales*) in 1613; *Viaje al Parnaso* (*Journey to Parnassus*) in 1614; *Ocho comedias y ocho entremeses nuevos* (*Eight New Comedies and Interludes*) in 1615; and *Los trabajos de Persiles y Sigismunda*, a posthumous work, in 1617. Thus clearly his richest literary crop belongs to the last decade of his existence, the work of a man over sixty, and as such bears the stamp of ripe wisdom, of graciousness, and generous love. These last years Cervantes spent in Madrid where, before his death, he joined a religious order, La Venerable Orden Tercera (Tertiaries of St. Francis), in the robes of which he was buried.

Cervantes became immortal through *Don Quixote*, one of the world's greatest literary monuments. In this satire of the romances of chivalry Cervantes gathered not only the rich experiences of his life, but, an indefatigable reader endowed with a retentive memory, he rendered as well brilliant echoes of Spanish, Italian, and Latin culture. His knowledge of the literature dealing with knight errantry was inexhaustible; his handling of dialogue compares with the best of the playwrights of the Golden Age; and his familiarity with his native country enabled him to present a broad and most illuminating fresco of the Spanish society of his epoch.

Beneath the humorous surface of Cervantes' book lies a deep satire, tragic at times, of the idealistic excesses and follies of chivalrous Spain, whose decline Cervantes seems, almost uncannily, to intimate. His main characters, Don Quixote and Sancho Panza, are universal symbols; their exploits and philosophies influenced innumerable writers, and have led to the production of a vast critical body. Considering their craftsmanship and consummate artistry *The Cautionary Tales* (*Exemplary Novels*) are equally mature and brilliant and they had, too, a wide repercussion upon the literature of England and the Continent.

Although Cervantes was essentially a poet, his formal achievement in verse never soared to the heights or attained the lyrical perfection of his many gifted contemporaries. As a playwright he is still remembered for his historical tragedy in verse *La Numancia* and for his amusing *Interludes*, masterfully translated in 1948 by S. Griswold Morley.

With the exception of J. Ormsby's version (1885), the most readable English translations of *Don Quixote* are the ones by Samuel Putnam (New York 1949) and, especially, J. M. Cohen (Penguin Books 1950). A comprehensive work in English on Cervantes and his influence is A. Flores and M. J. Benardete, eds., *Cervantes Across*

the Centuries (New York 1947). See also DON QUIXOTE; EXEMPLARY NOVELS.

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ANGEL FLORES,
Professor of Spanish Literature, University of Wisconsin.

CERVANTITE, sŭr-văn'tit, or **ANTI-MONY OCHER**, is native antimony oxide, $Sb_2O_3 \cdot Sb_2O_5$. It usually occurs in crusting stibnite and other antimony ores. It has a pale yellow color and greasy luster.

CERVERA Y TOPETE, thër-vä'rä ê tô-pä'tä, Pascual (CONDE DE JEREZ, hâ-râth', MARQUÉS DE SANTA ANA, sän'tä ä'nä), Spanish naval officer: b. Medina-Sidonia, Cádiz, Spain, Feb. 18, 1839; d. Puerto Real, April 3, 1909. During the period 1848–1851 he was educated at the naval academy at San Fernando. He was made a first lieutenant in 1859 and participated in naval operations on the Moroccan coast during the campaign of 1859–1860. In 1868 he was promoted captain and subsequently admiral. He played an important role in the first Cuban revolt (1868–1878) when he succeeded in blockading the ports and preventing the landing of filibusters.

In 1891 he went to London as head of the Spanish commission at the naval conference, and in 1892 was minister of marine. After the outbreak of the Spanish-American War in 1898 he commanded the fleet sent against the American squadron in Cuban waters. He took refuge in the inner harbor of Santiago de Cuba, and when he attempted to escape on July 3, under orders from his superiors, his entire fleet was destroyed by the American squadron. Admiral Cervera and his surviving officers were sent to Annapolis, Md., as prisoners of war, but soon afterward were released and allowed to return to Spain. In 1901 he was made vice admiral, and in 1902 chief of staff of the Spanish Navy.

CERVIDAE, sër'vî-dē, the deer family, a group of ruminant ungulates, having as its most noticeable characteristic the presence in the males of branched appendages to the skull, called antlers. These are lacking in certain species which are related, however, to the antlered deer. Only among reindeer do the females have antlers (q.v.). Other peculiarities of the family are the absence, except in *Moschus*, of a gall bladder and the usual presence of face and foot glands.

The approximately 35 species occurring in northwest Africa, Eurasia, and the Americas may be divided into five subfamilies. The Moschinae, containing only the musk deer (q.v.) of East Asia, are hornless and lack several other characteristics of other Cervidae. The Hydropotinae, including only the Chinese water deer, are also hornless, but otherwise like typical deer. The Muntiacinae of East Asia comprise chiefly the muntjacs (q.v.). Short antlers are borne on long bony pedicels. All three of these subfamilies have canine tusks especially well-developed in males. The remaining deer, in which the males lack canine tusks and bear the antlers on short pedicels, are divided into two subfamilies. The Cervinae

contain most of the Old World deer together with the wapiti (q.v.), while the *Odocoileinae* contain the remaining American deer as well as the Old World elk, reindeer, and roe deer (qq.v.).

The earliest known deer, the fossil *Eumeryx* and *Amphitragulus*, were small creatures somewhat similar to the living *Hydropotinae* in being totally hornless. Not until the middle of the Miocene have deer been found with antlers. Later came deer with branching horns, culminating in a European species, now extinct, the giant Irish elk, whose palmated antlers spread 10 to 12 feet; it was actually a huge fallow deer. See also **DEER**.

KARL KOOPMAN.

CERVIN, Mont, French name for the mountain in Switzerland better known as the Matterhorn (q.v.).

CERVOLLE, sër-völ, or **CERVOLE**, Armande de, French bandit chief, surnamed "The High Priest." He was taken prisoner with King John at the Battle of Poitiers in 1356, and after being ransomed, plundered the south of France with a band of troopers (*rouitiers*), and exacted tribute from Innocent VI at Avignon. He served for a time under the Dauphin, and pillaged Burgundy, Champagne, Alsace, and Lorraine. In 1365 he was made chamberlain to Charles V, and the next year he was murdered.

CESALPINO, chā-zāl-pē'nō, **Andrea** (Latin *ANDREAS CAESALPINUS*), Italian philosopher, botanist, and physician: b. Arezzo, Italy, 1519; d. Rome, Feb. 23, 1603. He studied medicine at the University of Pisa, where he secured a doctor's degree in 1551. In 1555 he was appointed professor of *materia medica* at Pisa, and also director of the university's botanical garden. He was the author of a valuable work, *De Plantis* (Florence 1583), in which he classified plants by their parts of fructification. To this work Carolus Linnaeus, Bernard de Jussieu, and other subsequent botanists were greatly indebted for their ideas of botanical classification. In 1592 he removed to Rome to become physician to Pope Clement VIII. He propounded in his *Daemonum investigatio peripatetica* (1580) the theory of the circulation of the blood, afterward adopted and demonstrated by William Harvey. Other works included *Quaestionum medicarum* (1593); *De Metallicis* (1596).

CESAR BIROTTEAU, a novel of French business life, published in 1837 by Honoré de Balzac (q.v.). It is, perhaps, the most notable in a noteworthy group of tales known under the general title of *La Comédie Humaine*. It deals with business venture and the chicanery of unscrupulous finance, with the cumulative entanglements of debt, and the legal snares of usurious oppression. In this novel these are viewed from the point of view of a prosperous tradesman, with chivalrous standards of commercial honor, whom success in his own field betrays into ventures in unfamiliar regions where he falls among thieves, men whom he thought he had special reason to trust. It is, Balzac says in his preface, "the obverse of a medal whose reverse is *La Maison Nucingen*," which deals, somewhat less genially, with the same theme from the side of the exploiters of men of too credulous probity. César, a brother of

Balzac's memorably unfortunate Curé de Tours, had prospered as a manufacturing perfumer during the consulate and the empire, though his relations to militant royalists had brought him a wound in connection with the conspiracy of Vendémiaire, 1795, which seemed to give him a title to the aid of royalist sympathizers after the Restoration. One of these was the very unscrupulous and successful Baron Nucingen. Du Tillet, once Birotteau's headclerk and a betrayer of both his domestic and his mercantile confidence, but now a financial shark and confederate of Nucingen for his baser needs, interests Birotteau, at a moment when his ambition reaches full bloom in a nomination as chevalier of the Legion of Honor, in a speculation and in imprudent expenditure by which his wealth becomes theirs and he a bankrupt debtor. By heroic exertion, four years' persistent labor, and scrupulous economy, aided by Popinot, another type of industrialist, who was later to marry Birotteau's worthy and charming daughter Césarine, the debtor discharges the whole of his liabilities, dying from the relaxing of the strain immediately after his solemn rehabilitation and the restoration of his commercial honor and coveted decoration by the courts. The story is less to be commended as a whole than for its portrayals of character, especially of the two druggists, the generous and loyal Popinot and the smug materialist Matifat, of the gentleman-scoundrel Du Tillet, and the ingenuously gracious Césarine, and most of all for its minute pictures, drawn it may well be from Balzac's own frequent memories, of the mental and moral tortures of César in his cumulating commercial embarrassments. There are four English translations.

BENJAMIN W. WELLS.

CESARI, chā'zā-rē, **Giuseppe**, CAVALIERE D'ARPINO (called IL GIUSEPPINO), Italian painter: b. Rome, 1568?; d. there, July 3, 1640. The son of a native of Arpino, he was widely esteemed for his religious paintings, which tended more toward idealism than realism. In the year 1585 he received his first commission from Pope Gregory XIII, who appointed him one of the group employed in the decoration of the Vatican. No less than five popes honored him. Clement VII created him Cavaliere de Cristo. In style, he was one of the later mannerists. The finest examples of his work include frescoes in the Capitol, at Rome, and in the Borghese chapel of Santa Maria Maggiore; the huge *Ascension* in the Church of Saint John Lateran; frescoes of the Olgisti Chapel, in Santa Prassede; designs for mosaics in the dome of Saint Peter's. A number of his smaller pictures may be found in various galleries. These include *Persens* and *Andromeda* (Metropolitan Museum of Art, New York); *Adam* and *Eve Expelled from Paradise* (Louvre, Paris); a self-portrait (Uffizi Gallery, Florence). His works—in fresco and oil—display lively imagination, and great vigor in execution, although the broadness of his treatment has often been subjected to severe criticism by the more formal stylists of later periods.

CESARINI, chā-zā-rē'nē, **CARDINAL Giuliano** (known as **CARDINAL JULIAN**), Italian ecclesiastical diplomat: b. Rome, 1398; d. Varna, Bulgaria, Nov. 10, 1444. Educated at the University of Perugia, he became professor of jurisprudence at Padua. He was counselor to Pope Martin V,

who made him a cardinal in 1426 and bishop of Frascati. Failing to coerce the Hussites, at the Council of Basel, of which he was president from 1431, he tried to settle their differences with Pope Eugenius IV. From 1438 he took part in the negotiations carried on with the Eastern Church, and Eugenius IV sent him as legate to Poland to stir up a crusade against the Turks. He met his death at the Battle of Varna (Stalin).

CESAROTTI, chā-zā-rōt'tè, Melchiorre, Italian poet: b. Padua, May 15, 1730; d. there, Nov. 4, 1808. He taught rhetoric at Padua, and in 1762 he went to Venice, publishing in 1763 a translation into Italian of *The Poems of Ossian* by James Macpherson. Besides translations, his works included *Saggio sulla filosofia della lingue* (1785) and *Pronea* (1807); the latter was a poem in praise of Napoleon, who made him knight of the Iron Crown. Giuseppe Barbieri completed the 40-volume edition of his works (Pisa 1800-1813).

CESENA, chà-zā'nā, city, Italy, in the Province of Forlì, the episcopal see of Emilia, on the Savio, 52 miles southeast of Bologna. Notable buildings include a library built in 1452 for Domenico Malatesta Novello. In a church of the Capuchins is one of the finest paintings by Guercino (Giovanni Francesco Barbieri). Hemp, vegetables, wine, sulphur, and silk are items of trade. Cesena was the birthplace of Popes Pius VI and VII. In 1357, under Maria Ordelaaff, wife of the lord of Forlì, the town made an unsuccessful defense against the papal troops led by Gil Alvarez Carillo de Albornoz. It was pillaged in 1377 by Cardinal Robert of Geneva (later the antipope Clement VII). Pop. (1948) 70,212.

CESIUM, a metal of the Ia group known as the "alkali metals." The name is derived from a Latin word meaning "light blue," and refers to characteristic blue lines in its spectrum. Cesium was the first element to be discovered by the aid of the spectroscope, this being accomplished by R. W. Bunsen and G. R. Kirchhoff in 1860. Cesium is somewhat more abundant in the earth's crust than silver. Although the amount present in carnallite is small, cesium has been produced in quantity from the residues of the potash industry in Europe. Several extensive deposits have been found in the United States, the most noteworthy being in the Black Hills of South Dakota. The most important source of cesium is pollucite, whose mineralogical formula is $2\text{CsO} \cdot 2\text{Al}_2\text{O}_3 \cdot 9\text{SiO}_2 \cdot \text{H}_2\text{O}$. Cesium may be extracted from its ores by mineral acids, and isolated in the form of double chlorides of lead or antimony. The metal may be produced by reduction of the carbonate or hydroxide by magnesium or aluminum in a current of hydrogen. It is a silvery white metal melting at 28.45°C . and boiling at 630°C . Its specific gravity at 0°C . is 1.903. Cesium is extremely reactive, forming oxides in dry air, igniting in moist air, and liberating hydrogen from water with explosive violence. Cesium has an atomic weight of 132.91 and an atomic number of 55. The salts of cesium resemble those of the other alkali metals. There are a number of isotopes of cesium resulting from nuclear reactions, but only the 133 isotope is found in nature. Cesium is the heaviest of the alkali metals.

The chief industrial use of cesium is in vacuum tubes. Because of its extreme reactivity, it removes the residual gas in evacuated tubes. Cesium metal is produced in the tube by the action of calcium on the chloride, high-frequency current furnishing the necessary heat. Cesium, alloyed with other metals such as antimony, bismuth, and gold, has the property of releasing electrons under the influence of light, and is thus employed in photoelectric tubes.

CESNOLA, chāz-nō'lā, Luigi Palma di, Italian-American army officer and archaeologist: b. Rivarolo, Italy, July 29, 1832; d. New York, New York, Nov. 21, 1904. From 1849 until 1859 he served in the Crimean War. Going to the United States in 1860, he taught in New York City until the Civil War, when he joined the Union forces as a major. Captured at Aldie, Va., in 1863, he was exchanged the next year. In 1865 he was brevetted a brigadier general and was naturalized. For the next 11 years he was United States consul at Cyprus, where he conducted archaeological researches. His collection of antiquities was purchased in 1873 by The Metropolitan Museum of Art, New York; from 1879 until his death he served as secretary and director of that institution.

CESPEDES, sās'pā-thās, Carlos Manuel de, Cuban revolutionist: b. Bayamo, April 18, 1819; d. March 22, 1874. In 1843 he was in the conspiracy led by Juan Prim y Prats and was banished from Spain. After returning to Cuba, he led the armed revolt (1868) which began the Ten Years' War. In 1869 he was elected president of the republic set up by the revolutionists, but was deposed in 1873. He was killed in a skirmish with the Spaniards.

CESPEDES, thās'pā-thās, Pablo de, Spanish painter, sculptor, architect, and poet: b. Córdoba, 1538; d. there, July 26, 1608. After studying at the University of Alcalá de Henares, he went to Rome, where he studied under Federigo Zuccaro the works of Raphael, Michelangelo, and others. Returning to Spain in 1577, he was made a canon of Córdoba Cathedral, and from that time he resided alternately in his native town and in Seville. One of his most celebrated paintings is a *Lord's Supper* in Córdoba Cathedral.

CESPEDES Y QUESADA, Carlos Manuel de, Cuban statesman, son of Carlos Manuel de Céspedes (q.v.); b. New York, New York, Aug. 12, 1871; d. Havana, Cuba, March 28, 1939. He held many diplomatic and government posts, serving in Rome, Athens, and Buenos Aires, and was minister to the United States from 1913 to 1922. When Gerardo Machado was overthrown in August 1933, Céspedes became provisional president of Cuba from August 12 to September 5, but was forced to resign after a coup d'état by students and the army. He was ambassador to Spain (1934-1936), after which he retired.

CESSIO BONORUM, sēsht'ō bō-nō'rūm ("surrender of goods"), a process by which, according to the law of Scotland, a debtor against whom a warrant of imprisonment was issued, after being charged to pay his debt, was entitled to be free from imprisonment, if innocent of fraud, on surrendering his whole estate to his

creditors. This procedure avoided infamy, and the debtor could not be deprived of the bare necessities of life. Since the abolition of imprisonment for debt a debtor may be compelled to make *cessio bonorum* at the instance of a creditor. Any property accumulated after this surrender is liable to attachment so long as the debt is not wholly paid. Both the phrase and essentially the same procedure occur in Roman law.

CESTI, chās'tè, Marc' Antonio, Italian composer; b. Arezzo, Italy, Aug. 5, 1623; d. Florence, Oct. 14, 1669. Maestro di capella at Florence and vice kapellmeister at Vienna, his operas include *Dori* (1660) and *Il pomo d'oro* (1667).

CESTIUS, sēs'ti-ūs, the name of a plebeian gens of Rome, of which two memorials have been preserved. One of them is a bridge connecting the island of the Tiber with the right bank of that river. The other, the Pyramid of Cestius, is the tomb of Gaius Cestius, Roman praetor and tribune of the people, who lived during the 1st century B.C. Standing at the gate of San Paolo, partly within and partly without the walls of Aurelian, this pyramid is about 125 feet high and 95 feet broad at its base. It is built of bricks, encased with blocks of marble.

CESTODA, sēs-tō'dà, or **CESTOIDEA**, sēs-toi'dè-à, or tapeworms, a class of the phylum Platyhelminthes. The class is characterized by an elongate, ribbon-like, usually jointed body. The segments, or proglottids, contain complete sets of reproductive organs. After transfer to the first (primary) host, the cysticercus, or bladder worm, grows into a chain.

Cestodes are parasitic in the various types of vertebrates only, though some bladder worm stages occur in worms, crustacea, and insects of various sorts. In the rare monozoic cestodes (Cestodaria), the simple body contains only a single set of sex organs; in the polyzoic cestodes, there are many such sets. The latter group contains five orders: Pseudophyllidea, Tetrphyllidea, Diphyllidea, Tetrarhynchidea (Trypanorhyncha), and Cyclophyllidea. The fish tapeworm of man falls in the first order and all the others from the human host in the last. Some zoologists classify Cestoda and Cestodaria as the two subclasses of the class Cestoidea. See also **PLATYHELMINTHES**; **TAPEWORM**.

CESTRACION, sēs-trā'shī-ōn, a genus of primitive sharks, also known as *Heterodontus*, of which the best known species is the Port Jackson shark of Australia (*C. philippi*). Four species are known, varying in length from four to five feet. They feed mainly on various kinds of mollusks. The family Cestraciontidae, though now represented by a single genus of four species, was very abundant in the earlier geological periods.

CESTRUM, sēs'trūm, a genus of the Solanaceae or Nightshade family. Tender shrubs, native in Central and South America, popular in temperate North America as greenhouse plants, and grown in the open in Southern California and elsewhere in the South. The flowers are tubular, in axillary or terminal clusters, red, yellow, greenish or white, and often very fragrant. *Cestrum nocturnum*, known popularly as night-blooming jessamine (jasmine), is a large shrub of

the West Indies. Its small greenish-white to cream-colored flowers give off at night a fragrance so penetrating that a small cluster of flowers will scent a large room. A similar but smaller shrub is *C. parqui* from Chile, the hardiest of the species. *C. diurnum*, the largest of these three species, has white flowers and is called day jessamine because it blooms in the daytime.

Consult Bailey, L. H. and E. Z., *Hortus Secundus*, p. 164 (New York 1947); also Negebauer, E. M., *Horticulture*, 30:142, 143 (Boston 1952).

ARTHUR H. GRAVES.

CESTUI QUE TRUST, sēs'twè kē trūs in law, the person for whose benefit a trust is created. In modern terminology, such a person is often described simply as a "beneficiary." Sufficient identification of the *cestui que trust*, or beneficiary, is generally an essential element in the creation of a trust, except a charitable trust. It is not necessary that the beneficiaries be in existence at the time a trust is created, but a trust cannot be created in favor of a person who is dead. There may be one or more beneficiaries, and the creator of the trust may himself be one of the beneficiaries or the sole beneficiary. In general, a person or corporation having capacity to take and hold legal title to property has capacity to be the beneficiary of a trust of such property.

RICHARD HIRSHBERG.

CESTUS, sēs'tūs (Lat. girdle), a band, or zone, said to have been worn by Aphrodite or Venus, and endowed with the power of exciting love toward the wearer. The following is Pope's translation of Homer's description of it:

In it was every art and every charm
To win the wisest, and the coldest warm—
Fond love, the gentle vow, the gay desire,
The kind deceit, the still-reviving fire,
Persuasive speech, and more persuasive sighs,
Silence that spoke, and eloquence of eyes.

CESTUS, or **CAESTUS**, the boxing glove of the Grecian and Roman pugilists. It consisted of thongs or bands of rawhide or leather, fastened to the hand and reaching to the wrist. It was afterward enlarged so as to reach up to the elbow and loaded with metal to increase the weight of the blow. The combat with the ordinary unloaded cestus was not more dangerous than a common modern boxing match. Theocritus' *Idyll* (book XXI) and Virgil's *Aeneid* (book v, p. 362) describe one of these combats.

CETACEA, sê-tā'shê-à, an order of mammals whose structure is so modified as to render them fit for an aquatic life. The whalebone whales, the toothed whales (the porpoise, narwhal, etc.), and the extinct zeuglodon represent the leading divisions of the group. The body is fish-like in form, the head passing gradually into the trunk, which tapers posteriorly and ends in a bilobate caudal fin which is placed horizontally, not as in the fishes, vertically. The posterior limbs are wanting, and the anterior are converted into broad paddles, or flippers, consisting of a continuous sheath of the thick integument, within which are present representatives of all the bones usually found in the forelimbs of mammals, but they are not movably articulated, so that the paddle moves like a solid oar. The fishlike aspect is further increased by the presence of a dorsal fin; but this is a simple fold of integument

and does not contain, as in fishes, any bony spines. The vertebrae of the neck, seven in number, are united more or less to each other, so that in some they form a single solid piece. The right whale and its allies have no teeth in the adult state, their place being taken by the triangular plates of balen, or whalebone, which are developed on transverse ridges of the palate. But the fetal whales possess minute teeth, which are very soon lost. The porpoises, etc., when they possess teeth in one or both jaws, have them numerous and conical in form; they have no milk predecessors. The stomach is divided into several chambers, but these are not, as in ruminants, connected directly with the gullet; they are rather appendages of the pyloric portion of the organ.

The arrangement of the respiratory and circulatory systems, which enables the Cetacea to remain for some time under water, is interesting. The nostrils open directly upward on the top of the head and are closed by valvular folds of integument, which are under the control of the animal. When the animal comes to the surface to breathe it expels the air violently, and the vapor it contains becomes condensed into a cloud; if the expiration commences before the mouth of the spiracle, or blowhole, is above the surface, a little water may be blown up like spray but no water from the mouth is thus discharged, for the soft palate firmly embraces during life the upper end of the larynx, so that the gullet is divided into two narrow passages, while the lungs have a continuous passage to the exterior. The blood vessels, especially those of the thorax and spinal canal, break up into extensive plexuses, or networks, in which a large amount of oxygenated blood is delayed, and thus the animal is enabled to remain under water, the necessity for changing the air in the lungs being diminished.

Fossil Cetacea.—Bones of cetaceans, mostly allied to the living species, are found in the marine sediments of the Tertiary and Quaternary ages, and are occasionally dredged up from deep-sea deposits. The hard and heavy carbonates are especially apt to be preserved as fossils. The Zeuglodon and Squalodon of the Eocene epoch represent a peculiar primitive group of cetaceans with two-rooted teeth. Very little is known of the evolution of this order of mammals. The Tertiary deposits of Patagonia are supposed to be rich in material bearing on the evolution of the Cetacea.

Classification of Cetacea.—The suborders of cetacea are as follows:

(1) **MYSTACOCETI**—cetaceans with whalebone. Its families include Balaenopteridae—rorquals and other great whalebone whales; Balaenidae—right whales and the pygmy whale (genus *Kogia*).

(2) **ODONTOCETI**—cetaceans with teeth. Its families include Physeteridae—sperm whales; Ziphiidae—beaked whales; Delphinidae—dolphins, porpoises, white whales, and killer whales; Platinistidae—river dolphins; and the extinct Squalodontidae.

(3) **ARCHAROCETI**—containing the extinct family Zeuglodontidae.

See also **WHALE** and the names of the various groups and species of cetaceans.

CETATEA ALBA. See **BELGOROD-DNESTROVSKI**.

CETEWAYO or **CETYWAYO**, sèt-è-wá'ò or kèt-è-wá'ò (Zulu, KETCHWAYO, kè-chwá'yò), king of the Zulus: b. about 1836; d. Ekowe,

Zululand, Feb. 8, 1884. He shared sovereignty over the Zulus with Panda, or Umpande, his father, from 1857 until the latter's death in 1872. The British government then recognized him as sole ruler, but because of his lawlessness war ensued early in 1879. He defeated a British force on Jan. 22, 1879, at Isandhlwana, or Isandula, near the Buffalo River, about 10 miles from Rorke's Drift. His Zulus were routed at Ulundi on July 4, 1879, and he was captured on Aug. 28. In August 1882, after living in exile in Cape Colony, he was taken to London, and on Jan. 29, 1883, he was reinstated as ruler over a portion of his kingdom. Soon, however, he was attacked by rival chiefs, and within less than a year he was compelled to seek protection of the British in the native reserve. There he died.

CETHEGUS, sê-thê'gûs, **Gaius Cornelius**, Roman statesman: d. Dec. 5, 63 B.C. An accomplice in Catiline's conspiracy to assassinate the consuls, he was condemned by the Senate and executed at the instigation of Cicero.

CETHEGUS, Marcus Cornelius, Roman general and politician: d. 196 B.C. He became curule aedile in 213 B.C., censor in 209, and consul in 204. In 203, as proconsul in Cisalpine Gaul, he was successful in driving the Carthaginian army of Hannibal's brother Mago from Italy. He was known as a persuasive orator.

CETINA, thâ-tê'na, **Gutierre de**, Spanish lyric poet and soldier: b. Seville, Spain, c.1520; d. Los Angeles, Mexico, c.1570. After fighting in Italy and Germany under Holy Roman Emperor Charles V, he returned to Seville in 1545 but shortly went to Mexico, where he resided until his death. His madrigal *Ojos Claros Serenos* was in the style of Petrarch. Many of his sonnets were written under the name of Vandalio.

Consult Withers, A. M., *The Sources of the Poetry of Gutierre de Cetina* (London 1923).

CETINJE, tsê-tê-nyê, town, Yugoslavia, in Montenegro Republic, about 25 miles west-southwest of Titograd (formerly Podgorica), situated on the lower slopes of Mount Lovcen and connected by road with Titograd and with the Adriatic seaport of Kotor (formerly Cattaro). Founded in 1484 by the Montenegrin ruler Ivan Crnojević (Ivan the Black) as a bulwark against the Turks, Cetinje was the capital of the former kingdom of Montenegro until Montenegro was absorbed by the kingdom of Yugoslavia after World War I. The town contains a fortified monastery established in 1478, the tombs of many Montenegro rulers, and the royal palace, now a museum. It was sacked and burned by Turkish invaders in 1683, 1714, and 1785. It was replaced by Titograd in 1946 as capital of Montenegro Republic. Pop. (1948) 9,109. See also **MONTENEGRO**.

CETTE. See **SÈTE**.

CETUS, sê'tûs (Lat. whale), a large constellation, lying on both sides of the celestial equator, but mainly on the southern. Ptolemy (Claudius Ptolemaeus) included it in the list of constellations in his *Almagest*. It is bounded by Pisces, Aries, Taurus, Eridanus, Fornax, Sculptor, and Aquarius. In Greek mythology, Cetus was the sea monster from which Perseus rescued Andromeda. Its brightest star is Deneb Kaitos (β

Ceti), of +2.24 magnitude; but the most famous is Mira (o Ceti; also known as Omicron), a long-period variable, discovered by David Fabricius in 1596.

CETYL, sět'il, a chemical radical corresponding in structure to the ethyl compounds. It is formulated as $C_{16}H_{33}$. Its compounds are derived from spermaceti and beeswax.

CEULEN, kù'lën, or **KEULEN**, Ludolph van, Dutch mathematician: b. Hildesheim, Jan. 28, 1540; d. Leiden, Dec. 31, 1610. While professor of fortification at Leiden he calculated the value of π to 35 decimal places; this computation is sometimes known as Ludolph's number.

CEUTA, thā'ōō-tā, Morocco, a strongly fortified place belonging to Spain, on the African coast opposite Gibraltar. The town occupies the site of the Roman colony of Ad Septem Frates, so called from the seven hills rising here in a group, of which the most prominent are Almiña and Hacho. On the latter, the ancient Abila (one of the Pillars of Hercules), is a fort; on the former, among beautiful gardens, lies the new town. Ceuta contains a cathedral, a hospital, and convents, but is chiefly of importance as a military and penal station. It was a flourishing mart under the Arabs, and there the first paper factory in the Western World is said to have been established by an Arab who had brought the industry from China. In 1415 it was captured and annexed by Portugal; it fell to Spain in 1580. It resisted several sieges by the Moors (1694-1720 and 1732). Ceuta is part of the province of Cádiz. Pop. (1948) 63,062.

CEVENNES, sā-vën' (ancient CEBENNA), the chief mountain range in southern France between the Alps and the mountains of Auvergne; it lies mainly west of the Rhône. With its continuations and offshoots, it forms the watershed between the river systems of the Rhône and the Loire and Garonne. Its general direction is from northeast to southwest, beginning at the southern extremity of the Lyonnais Mountains, and extending under different local names as far as the Canal du Midi, which divides it from the northern slopes of the Pyrénées. It is divided into the South and North Cévennes. The Cévennes extend for over 150 miles, through or into nine departments, the central mass lying in Lozère and Ardèche, where Pic de Finiels attains 5,584 feet, and Mont Mézenc (the culminating point of the chain) 5,754 feet. The average height is 3,000 to 4,000 feet.

CEYLON, sê-lôn', a large island of the Indian Ocean, lies off the southeast coast of India between latitudes 5°55'N. and 9°50'N. and longitudes 79°42'E. and 81°53'E. It is separated from the mainland by Palk Strait in the north and the Gulf of Mannar in the west. Between the strait and the gulf is a ridge of sandbanks, known as Adam's Bridge, which nearly joins the island to the mainland and interferes with navigation except for small boats. In 1796 the British captured Dutch settlements on the island. They administered the area from Madras until 1798, when it was made a crown colony. In 1802, under the Treaty of Amiens, Ceylon was formally ceded to Great Britain. Since Feb. 4, 1948, Ceylon has been a dominion of the Commonwealth

of Nations. The flag is that of the Sinhalese kings, with a standing yellow lion against a red background, to which have been added a green stripe symbolizing the Moslem population and a saffron stripe for the Tamils.

Roughly pear shaped, with the broad end to the south, the island extends 270 miles from Point Pedro (Point Palmyra) in the north to Dondra Head in the south. Ceylon's greatest breadth, from Colombo to Sangamankanda, is approximately 140 miles. The total area is 25,332 miles, or a little over half the size of New York State. The principal cities are Colombo (1946 population, 353,374), the capital, largest city, and principal seaport; and Jaffna (estimated 1946 population, 63,000), Dehiwala-Mount Lavinia (56,900), Kandy (51,200), Moratuwa (50,700), and Galle (49,000). Kandy, a former capital, is noted for its Buddhist temples, including Daladā Mālagāwa, the most sacred of all Buddhist temples.

The Land.—*Topography.*—Structurally, Ceylon is an extension of the south Indian plateau. The major portion of the island is composed of very ancient Archean gneisses overlain in many sections with thick metamorphosed sediments, such as quartzite, granulite, and crystalline limestone, which together make up the Khondalite system. The Khondalite series is folded into a complex syncline with a general north-northwest, south-southeast axial trend. The only other important rock type is a sedimentary Miocene limestone which fringes the northwest coast and covers the Jaffna Peninsula. The island is divided into three fairly distinct levels or zones. The highest level or terrace appears at 6,000 feet; the intermediate level, at around 1,600 feet; the lowest terrace, at 100 feet. Rising above the highest terrace, where local relief is considerable, are the highest peaks of Ceylon, the sacred Adam's Peak (7,365 feet), said by Moslems to contain the footprint of Adam, and Pidurutalagala (8,292 feet), the highest point on the island. The drop from the highest terrace to the 1,600-foot level is quite abrupt. Here there is considerable local relief with ridges and isolated hills rising from the terrace floor. The lowest terrace covers the northern two thirds of the island and is generally overlain with alluvial material. The average elevation of this plain is about 100 feet, though isolated hills rise to 200 or 300 feet above sea level.

The rivers form a radial pattern from the central highland core. Streams are generally short and swift; the longest, Mahaweli Ganga, a little over 200 miles in length, empties into Trincomalee Bay. Waterfalls, one of the major scenic attractions, are characteristic where the rivers drop from one terrace level to the next. The typical coastline is low with offshore coral reefs and sandbanks topped with dunes behind which lie both fresh- and brackish-water shallow lagoons. Coral flourishes all around the island, and most of the sand deposited on the beaches and dunes is composed of comminuted coral. Occasionally rocky headlands reach the water's edge, as at Galle on the southwest tip of the island. Although there are frequent inlets, the harbor facilities at Colombo itself are largely artificial, breakwaters having been constructed to afford protection from the open sea on both the north and west sides. Trincomalee, however, on the northeast coast, is reputed to be one of the finest natural harbors in the world.

Climate.—Ceylon's location and its local relief

features are the two chief determinants of its climate. Proximity to the equator gives the island a generally uniform tropical climate, but local elevation modifies the intensity of the heat. The lowlands are uniformly and continuously hot at all seasons, with average temperatures around 80°F. Seasonal variations generally amount to only 3° or 4°F., but they are slightly greater in the extreme north. Diurnal ranges are much greater than seasonal ranges. On clear days at Colombo it is not uncommon for day and night temperatures to differ by 15°F. In the highlands temperatures decrease in almost exact ratio to elevation. At Nuwara Eliya, above 6,000 feet, the average January temperature is 54°F., while in May, the hottest month, the average is 62°F. These differences between highlands and lowlands determine the kinds of crops which are raised at various elevations. While these average temperatures do not seem excessive, they are accompanied at all times by a high humidity which makes the heat feel more intense.

Rainfall on the island, as in India, is dominated by the monsoon winds. The seasonal change in wind direction causes a change in the location of the area of heaviest rainfall. In addition to rainfall resulting from the monsoons, local thunderstorms and tropical cyclones, especially during the intermonsoon periods, bring some rain to the island. The rainiest section is in the southwest. Here the rainfall everywhere is over 75 inches per year; on the windward slopes of the mountains it is in excess of 200 inches. The wettest period is in summer, during the southwest monsoon, but the balance of the year is by no means dry. The monsoon rains are generally heaviest in May. In the northern plains and in the extreme southeast, rainfall is everywhere less than 75 inches per year and many places receive less than 50. Moreover, rainfall here is much less reliable than in the southwest; it is primarily associated with the northeast (winter) monsoon winds; and there is a marked dry season with drought periods of up to 60 days in many sections, especially in the extreme north. Here irrigation is needed if agricultural production is to attain maximum yields. As a result of the marked contrast both in amount and in reliability of rainfall, this portion of Ceylon is agriculturally less productive than the southwest.

(W. F. C.)

Political Divisions and Population.—A census taken on March 19, 1946 gave the population of Ceylon as 6,695,605; of the total, 36,606 were nonresidents. The density was 262.8 persons per square mile. (In mid-1949 an official estimate placed the total population at 7,288,000.)

Table 1—PROVINCIAL AREAS AND POPULATIONS, 1946

Province	Area (in square miles)	Population	Percentage increase over 1931
Western	1,432	1,876,625	29.9
Central	2,290	1,134,584	19.0
Southern	2,146	962,006	24.7
Northern	3,429	479,639	20.2
Eastern	3,840	279,204	31.4
North-Central	4,000	139,581	43.4
North Western	3,016	668,192	22.2
Uva	3,277	373,059	23.0
Sabragamuwa	1,893	746,109	29.0
Total	25,332	6,658,999*	25.5

* Resident population.

The island is divided into 9 provinces, which are subdivided into 19 districts. A government agent is in charge of each province, and an assistant government agent of each district. Provincial areas and population-figures are given in Table 1; birth, death, and infant mortality rates, in Table 2.

(G. P. M.)

Table 2—BIRTH AND DEATH RATES; INFANT DEATHS (1941-48)

Year	Birth rate per 1,000 population	Death rate per 1,000 population	Infant deaths per 1,000 live births
1941	36.5	18.8	129
1942	36.7	18.6	120
1943	40.6	21.4	132
1944	37.1	21.3	135
1945	36.7	22.0	140
1946	38.4	20.3	141
1947	39.4	14.3	101
1948	40.5	15.2	92

The People.—The permanent population of Ceylon comprises Sinhalese (now, preferably, called Sinhalas); Tamils; Moors and Malays, together grouped as Moslems; Burghers, descendants, mixed and pure, of Portuguese and Dutch colonists of the 16th and 17th centuries; Eurasians; and Veddas (Veddahs), the remnant of an aboriginal stock. There is an Indian community of merchants and a larger group, mainly from south India, of estate laborers. There are also small communities of Europeans, Chinese, and Baluchis (commonly termed Afghans). In 1946 the number of immigrants was 282,925, of whom 95 per cent came from India; estate laborer Indian immigrants numbered 78,593. Emigrants numbered 226,135, of whom 97 per cent went to India; estate laborer emigrants numbered 75,939. The division of the permanent population by ethnic groups and religions is given in Table 3.

Table 3—ETHNIC GROUPS AND RELIGIONS, 1946 (in thousands)

Ethnic groups		Religions	
Sinhalese	4,637	Buddhists	4,288
Ceylon Tamils	826	Hindus	1,326
Moslems	393	Christians	606
Burghers, Eurasians, Euro-Ceylonee ..	36	Moslems	433
Indians	751	Others	5
Europeans	5		
Others	11		

The Sinhalese are the descendants of a north Indian people who are believed to have colonized the island in the 6th or 5th century B.C. They are generally divided into two groups, Low Country and Kandyan. The former inhabit the western and southern coastal areas, the latter the north central plain and the mountains. The division is not ethnic, but originated in the administrative cleavage caused by European occupation of the littoral. The Sinhalese are a handsome people, slender and well proportioned, with fine features and smooth black hair. The women, particularly, have a fine carriage and possess large, lustrous eyes. Skin color varies from light olive to dark brown. The Sinhalese are highly civilized, with a culture over 2,000 years old and four centuries' contact with Western thought. They are gentle and hospitable. The Ceylon Tamils, who live mainly in the arid north and the east, are an alert, industrious people who

came to political notice about the 14th century. Conservative descendants of south Indian colonists and invaders, they have largely retained their Indian way of life, unlike the Sinhalese, who early developed a civilization distinct from that of the subcontinent. The Moors engage chiefly in small-scale trade; the Malays, in services like the police and the fire brigade. The Veddas occupy the almost inaccessible forest regions of Uva and Eastern provinces. Once completely wild, they now cultivate dry crops, though they prefer hunting, for which they use a primitive firelock instead of the ancestral bow and arrow. They are a very dark people with pronounced Negroid features, speak a patois, and practice animism. They do not easily make friends with strangers. The Veddas are kin to the wild tribes dotting the forest patches of the arc extending from Borneo westward to India through the south Asian land mass. The Burghers have the lightest complexions of the permanent inhabitants. By endogamy a minority of the Dutch Burghers have preserved the European blood upon which they pride themselves, and they are striving to retain their individuality. The rest of the Burghers are merging into the other racial groups, notably the Sinhalese. Not long ago the Burghers filled the learned professions, such as law, medicine, and the church, or were prominent in European merchant firms. Their interests are becoming more diversified. The small Chinese community consists mainly of peddlers. The Baluchis are exclusively money lenders. (G. P. M.)

Natural Resources.—*Natural Vegetation.*—Forests cover some three fourths of Ceylon. Because of marked contrasts in rainfall and elevation the types of plants vary widely from place to place. The lower slopes of the mountains and the wetter portions of the lowlands, where the land has not been cleared, are covered with a thick, broadleaf evergreen forest composed of many species. Parasitic vines and creepers are common in the plant associations of these areas. On some of the higher plains where rainfall is scant, coarse grass is typical. In the highlands, where wetter conditions exist, temperate zone species prevail, and climbing plants are much less common. In those parts of the plains where a marked dry season is characteristic, thorn forest is typical. Elsewhere on the plains a dry zone forest with a great variety of trees, generally with small leaves and thick bark, is most frequent. It is from this type of forest that the slow-growing ebony and satinwood are obtained.

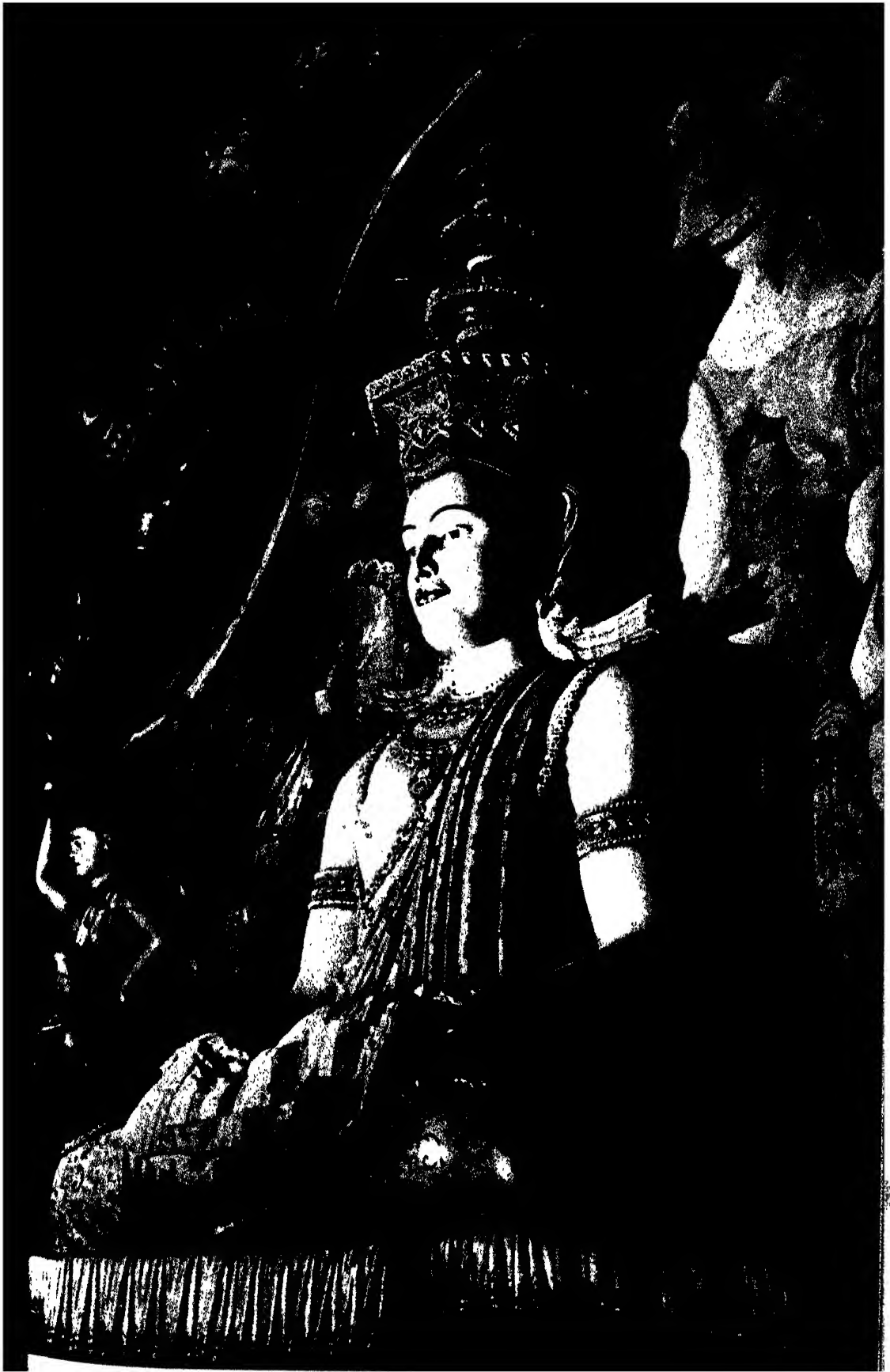
Animal Life.—Most of the animals found in India, except the royal tiger, are also native to Ceylon. Leopards and various types of small cats are common. In the northern and eastern provinces elephants are numerous, although their numbers have been greatly reduced by hunting. Bears, monkeys, wild hogs, and several species of deer are all found on the island. The bandicoot is a familiar garden pest, as it is in India. Great numbers of birds, many with bright plumage, are common. Especially numerous are pheasants, peacocks, partridges, and pigeons.

Mineral Resources.—Mineral wealth is neither extensive nor varied. The chief mineral industry, graphite (plumbago) mining, is subject to wide fluctuation both in the amount produced and in numbers employed. In 1940 about 18,000 were engaged in graphite mining; in 1946, only 1,785. Production dropped from a high of 27,734 tons

in 1942 to a low of 4,623 tons in 1946, but rose again to 14,194 tons in 1948. Commercial deposits occur in veins, lenses, and pockets in the Khondalite series. The principal markets are the United States and the United Kingdom. Good-quality mica occurs in the hill country, but mining has been haphazard, and production erratic. Precious and semiprecious stones, including sapphires, rubies, beryl, topaz, garnet, zircon, and many varieties of quartz, are obtained from the alluvial gravels derived from the Khondalite rocks. Since all gems are bought through auctions or private sales, no annual production figures are available; conservative estimates place the value at around \$500,000 per year. Iron ore sufficient to meet local needs is available, but coal is lacking, and cheap electric power is not yet a possible substitute. Although the island has considerable amounts of potential hydroelectric energy, relatively little had been developed by 1949. Colombo, with one exception, was the only city which provided electrical energy for other than domestic use and street lighting. Here an ever-increasing volume was used for industry. In Galle power was provided for a plywood factory at Gintota. In 1948 the island's electric power capacity was 21,000 kilowatts. Plans were under way in 1949 to develop hydroelectric energy; when completed, the projects were expected to give the island a total in excess of 100,000 kilowatts. (W. F. C.)

Agriculture.—Agriculture occupies a paramount position in the economic life of Ceylon. Fully 60 per cent of all gainfully employed persons are engaged directly in farming, and agricultural products account for well over 90 per cent of all exports. Despite this great emphasis on crop production, there is an inadequate supply of food for local needs. Food imports normally constitute one third or more of all imports; in 1948 they amounted to 52 per cent. Food supplies could be augmented considerably through the expansion of irrigation facilities in the dry portions of the north and in the southeast; in 1949 a three-year project to irrigate 120,000 acres in the Gal Oya Basin was begun.

Agricultural production falls into three major types: (1) the rice-coconut complex, (2) rice-vegetable-tobacco farming, and (3) plantation agriculture. The first two types are characterized by small-scale operations, intensive hand cultivation, and small capital investment. Plantation agriculture is generally carried on in large units, capital requirements are great, and financial success is geared to world market conditions. In terms of numbers employed, by far the most important is the rice-coconut type, localized in the southern three fourths of the island. It is the Sinhalese who practice this system. Rice is grown primarily as a subsistence crop; the coconut supplies some food, household articles, and a major cash crop. Some coconuts are grown under plantation methods, but the bulk of the island's production is derived from small-scale native plots. The rice-vegetable-tobacco form of agriculture is localized in the relatively unproductive soils of the Jaffna Peninsula and adjacent areas of the extreme north. This area is occupied predominantly by Tamils. Rice and vegetables are the chief food crops. Tobacco is grown on a commercial basis. Rainfall here is light (25 to 50 inches) and comes in the northeast monsoon period. Consequently irrigation is essential. The relatively infertile soil requires heavy



American President Lines

CEYLON: Seated figure of Gautama Buddha in the temple at Colombo, Ceylon. Note elaborateness of the background behind the statue.

CEYLON



Top: Colombo, Ceylon, street scene. Customs jetty in distance.

Center left: Singhalese pearl divers in Ceylon.

Center right: Among Ceylon's ancient monuments is this bas-relief, possibly belonging to the 7th century.

Left: The Kiri Vehera, a Ceylonese stupa or artificial hemispherical tower, containing a relic chamber, topped by a spire or "umbrella."

fertilization. Plantation agriculture is confined primarily to the hilly regions of the south. Tea (140,000 metric tons in 1948) and rubber (90,800 metric tons in 1949) are the dominant crops. Tea is grown from sea level to 6,000 feet, but the best qualities are obtained from the higher elevations; rubber is confined to elevations under 2,000 feet. (During the Portuguese and Dutch periods cinnamon was the chief plantation crop; in the 19th century coffee led all others, but in the 1870's a blight attacked the coffee tree, and cinchona was dominant for a brief period. It is only since the early 20th century that tea and rubber achieved first place.) Although rubber occupies a greater acreage than tea (573,243 in 1946 as compared with 533,830 in tea), its export value is far less: 14 per cent of the value of all exports in 1948, compared with 59 per cent for tea. World War II stimulated rubber production; its future seems less secure than that of tea.

An interesting agricultural system of Ceylon is chena cultivation. Under this system, practiced primarily in the dry zone, crops are grown on burned-off jungle land. As soil fertility decreases, the cultivator migrates to new areas. Fortunately this type is declining as lands are permanently cleared with government cooperation.

Acreage in principal crops, other than tea and rubber, in 1946 was as follows: rice (912,500), coconuts (920,093), vegetables and related crops (140,000), areca nuts (69,000), palmyra (50,000), cinnamon (33,077), citronella (30,107), cacao (19,700), cardamoms (6,000), and tobacco (2,656).*

Animal husbandry has occupied an unimportant place in the economy of Ceylon. After World War II four large cattle farms were started and attention was being given to the development of animals suited to the climate and to the production and processing of disease-free milk products. In 1946 there were 1,577,327 horned cattle, 296,151 goats, and 63,301 swine.

(W. F. C.)

Industrial Development.—Manufacturing is relatively unimportant in Ceylon, although shortages during World War II and attendant high prices and limited shipping space did much to stimulate industrial expansion along certain lines. Much of the war and postwar development was aided by government ownership and control. In 1939 the government built a coir factory to make such articles as camouflage material and bags for coal, tea, and salt. In 1946 some 5,000 workers were employed in the government-controlled machine phase of this industry. In addition, probably 50,000 were employed in cottage-type, small-scale coir spinning and weaving, some entirely under private control, some aided by the government. In 1941, a government plywood factory was built to supply tea chests, decorative panels, and furniture, and a shoe factory and a tannery were begun. In December 1942 a steel rolling plant using scrap metal was completed. Other government plants of wartime origin include a paper mill, a quinine factory, and a ceramics factory producing crockery and utility ware. The war also stimulated private development of such industries as those producing glass, matches, soap, hosiery, paper, twine, lacquered ware, and ink. The government assisted in the expansion of

many cottage-type industries, especially in such fields as textiles, pottery, rattan goods, mats, and handmade paper.

In the early postwar period the trend of industrialization was difficult to predict in detail, but certain features seemed fairly clear. First, there seemed little doubt that Ceylon would remain essentially an agricultural nation producing commercial crops. Second, the government would probably find it necessary to continue to play a major role in financing and controlling industrial expansion in such fields as power, heavy industry, fertilizer manufacture, cotton spinning, and certain pharmaceuticals. Third, for a considerable time private enterprise would probably be limited to consumers' goods for which processes are relatively simple, capital requirements small, and technical requirements at a minimum. Fourth, the cottage-type industry would continue to provide a source of income and supply many local necessities. (W. F. C.)

Trade.—The foreign trade of Ceylon consists primarily in the exchange of agricultural products for manufactured goods and food. While World War II had little effect upon the general character of the island's trade, it did modify it in detail and alter the direction of its movement, especially in imports. War-stimulated industries made the island less dependent on foreign sources for certain manufactured products than was true before the war. Disturbances during the war and in the postwar period cut off trade with Japan and interfered with the movement of rice from South-east Asia. The total value of both import and export trade increased manifold—imports, for example, from 236 million rupees to 985 million rupees between 1938 and 1948; exports, from 284 million rupees to 1,009 million rupees in the same period—but because of the very high prices that Ceylon had to pay for her imports (in 1948 the import price index was 525, on a base of 100 for 1934–1938, while the export price index was 344), there was relatively little real gain resulting from the increased value. In 1948 the major groups of import items and the percentage for each group included: food, drink, and tobacco, 52 per cent; manufactured products, 36 per cent; raw materials, 11 per cent. During the war there was a marked decline in the import of rice and a marked increase in the import of wheat and wheat flour, mostly from Australia, and bread has become an important item in the diet of many people in Ceylon. A marked increase in the import of preserved milk and milk foods was also noted. Tea, rubber, and coconuts dominated the export field in 1948, as they had for many years, tea accounting for 59 per cent, rubber for 14 per cent, and coconut products for about 13.5 per cent of the total export trade. A large portion of Ceylon's trade is with Commonwealth countries: 45 per cent of imports, and 52 per cent of exports, in 1948. In that year the chief sources of Ceylon's imports were the United Kingdom (17.4 per cent), Burma (17.4 per cent), India (12.8 per cent), Australia (12.7 per cent), and the United States (7.6 per cent). Exports in 1948 went primarily to the United Kingdom (29.8 per cent), the United States (16.3 per cent), Australia (8.3 per cent), Egypt (6.3 per cent), and the Union of South Africa (4.3 per cent). (W. F. C.)

Transportation and Communications.—All railways in Ceylon are government owned. The system, which comprises 806 miles of broad-gauge (5½ feet) and 106 miles of narrow-gauge

* These figures do not in many cases include holdings of less than one acre, of which there are many. The tobacco figures are inadequate, since they represent only the crop for one season and not for the entire year.

(2½ feet), focuses on Colombo and serves the southwest coast and the southern highlands, with two lines extending to the north, and two to the east coast. Large sections of the south and southeast are without rail service. There are over 17,500 miles of road and cart tracks in the island; 6,364 miles can be classed as main through arteries, of which 5,457 miles are surfaced and generally suitable for all-weather use. A series of canals along the southwest coast provides a water route of about 120 miles between Kalutara and Puttalam. Air transport is available to India, Pakistan, the United Kingdom, and Singapore. Colombo, one of the world's great entrepôts, has extensive wharfage facilities.

The telegraph and telephone systems are operated by the Post Office Department. As of Sept. 30, 1947, there were 1,046 post offices. In 1948 there were 11,110 miles of telegraph lines and 70,445 miles of telephone wires. The government maintains a broadcasting service with programs in English, Sinhalese, and Tamil. A great many newspapers and periodicals are published in Ceylon in all the major languages. (W. F. C.)

Economic and Financial Factors.—The standard unit of currency is the rupee; in May 1950 it was valued at 20.8 cents in U.S. money. The primary units of weights and measures are identical with those in Great Britain. There are some 15 banks doing business in Ceylon, many of them branches of Indian and British concerns. In addition, the post office savings banks, the State Mortgage Bank, and the Agricultural and Industrial Credit Corporation carry on limited and specialized banking functions. In 1950 the new Central Bank of Ceylon began functioning. Revenue was estimated at 565 million rupees in 1948-1949; expenditures at 532 million. In 1948 national income was about 2,272 million rupees. Between 1937 and 1950 the cost of living index rose from a base of 100 to 319. (W. F. C.)

Government.—The island as a whole first came completely under foreign control in 1815, and until 1931 was administered as a crown colony of Great Britain. In that year, the Donoughmore Constitution gave the island a great measure of self-government and almost entire control of finance. It also established universal suffrage. It provided government by ministers, of whom seven took office as chairmen of the executive committees into which the legislative assembly, the State Council, was divided. The broad model was the London County Council. In 1945 the Soulbury Commission made further changes, and on Feb. 4, 1948, Ceylon became a fully self-governing dominion in the Commonwealth of Nations. The postwar changes in Southeast Asia, particularly those which established the Dominions of India and Pakistan and led to the republican Union of Burma, doubtless accelerated the pace of Ceylon's progress to free nationhood.

The king is represented by a governor general. Parliament, on the British model, consists of two houses, the House of Representatives, with 101 members, and the Senate, with 30 members. The governor general nominates 6 members to the former, and 15 to the latter, to which the House of Representatives elects the balance. The interests of unrepresented minorities are safeguarded by nominations. The prime minister presides over a Cabinet of 14 members, whom he chooses. The first parliamentary elections, held in September 1947, gave a plurality of 42 seats to the United National Party, which came into

power with its chairman as prime minister. The opposition consisted mainly of Left-wing elements: the Communist (Stalinist) Party, and the Bolshevik Sama Samaja and Lanka Sama Samaja parties (both Trotskyist). The Ceylon Tamils allied themselves with their Indian brethren in the Tamil Congress Party. The Ceylon Indian Congress formed its own group. All of these joined in opposition to the United National Party. There were 21 Independent members. Subsequently, the government was strengthened by the accession of a number of Independents, by differences among the Left-wing parties, and by a major split in the Tamil Congress ranks, the leader of that group accepting a Cabinet appointment. The government in 1949-1950 was therefore a coalition. Complete executive power is exercised by the Dominion, which also controls all legislation. Certain appeals are allowed to proceed to the British Privy Council. The Supreme Court is the highest tribunal; it is presided over by a chief justice and several puisne judges. Of similar status are the commissioners of assize. There are a court of criminal appeal and other appellate courts presided over by one, or a board of, puisne judges. District, magistrates', requests', and rural courts exercise restricted powers. Civil law is based on the Roman Dutch law introduced by the Dutch in the 17th century. Criminal law is on the British model. Moslem marriages and divorces are governed by Koranic laws administered by boards of Kathis. The Ceylon Tamils have their own property law, known as Thesa Walamai. The police force operates under an ordinance of 1865, amended by later ordinances. At its head is a senior civil servant.

The prime minister is also minister for defense and external affairs. The island is represented by an ambassador in the United States, by a minister plenipotentiary in Burma, and by high commissioners in the United Kingdom, Australia, and India. In unrepresented countries its interests are served through the British government. India is also represented by a trade commissioner; Pakistan, solely by a trade commissioner. A citizenship law safeguards the island's position vis-à-vis nationals of other countries but enables them to be domiciled under conditions meeting the island's requirements. The law has had doubtful reception in India and Pakistan, but the influx of their nationals necessitated some restriction. The law also clarified the island's attitude toward countries seeking to discriminate against its nationals. The Ceylon Naval Volunteer Reserve and the Ceylon Army are the chief instruments of defense. Officers are trained in England. Defense is coordinated with British strategy and machinery.

Public health and welfare services and social legislation are advanced. The network of hospitals in the chief towns has been extended to remote areas, where numerous rural hospitals, maternity homes, and prenatal clinics have been established. Curative and preventive treatment is available at specialized clinics. In areas distant from transportation lines there is a system of outdoor dispensaries. There are also milk feeding centers for infants. Social legislation is administered largely by the Ministries of Health and Local Government and of Labour and Social Services.

Government service is controlled by the Public Services Commission, which recruits candi-

dates for higher government posts. The commissioners hold competitive examinations for young graduates seeking to join the civil service. Senior civil servants are appointed government agents. Each ministry is administered by a permanent secretary, generally a senior civil servant. Rural administration is under divisional revenue officers, aided by village headmen. Local government service covers the most remote areas. Cities and large towns are administered by municipalities, and smaller units by urban and town councils, while villages have village committees. Members are popularly elected. A local government commission unifies the service. (G. P. M.)

Way of Life.—The people of Ceylon are peace loving, law abiding, and gentle. They are tolerant of and receptive to new ideas. As a result, early Christian missionaries were welcomed warmly, although Christianity has made little headway since its introduction in the 16th century. Most Sinhalese are Buddhists; Tamils are Hindu by religion. The Buddhist Sabbath is reckoned by the four lunar phases. On these days Buddhists visit temples, offer flowers in memory of the Buddha, and listen to a sermon by a monk. The monks are celibate, eat but one meal a day, and live withdrawn from ordinary affairs. Religious ceremonies have comparatively little ritual, worship being individual. The Hindus are more ritualistic. Their priests are Brahmans, members of an exclusive priestly caste. Buddhist monks have no caste restrictions to prevent them from adopting a spiritual life, and they can renounce their religious calling at will.

Residents of towns live in semi-European style, but rural folk lead more natural and simpler lives. British law imposed monogamy except in the case of the Moslems. The Moors segregate their womenfolk, but there is a movement toward freedom. Malay women are not segregated. Tamil women are conservative, but neither the Sinhalese nor members of the other ethnic groups have imposed restrictions upon women. Family life is patriarchal, younger members being respectful toward their elders. Children are affectionately regarded. Marriages are arranged by parents, and the dowry system prevails. Property is inherited equally by all children in a family. The average meal consists of a large dish of boiled rice with several vegetables separately made into curries. Although meat and fish are eaten, the diet is mainly vegetarian. Most village folk chew betel leaf mixed with slices of areca nut, a pinch of burnt lime, and sometimes spices such as cloves and cardamoms. Persons educated in English, as well as those employed in government and other modern services, wear European clothes, but the majority of the population wear a cloth falling to the ankles and held at the waist, topped by a loose calico shirt or coat. In the villages many people normally are bare above the waist. Rural folk carry a large kerchief, shawl, or towel over one shoulder. Women wear bright-colored saris draped over the left shoulder, with a blouse underneath. Jewelry for hair, ears, neck, wrists, and sometimes ankles is much favored. Cricket, Rugby football, soccer, tennis, horse racing, and hockey are all popular, and national games are enjoyed in the rural areas. (G. P. M.)

CULTURAL LIFE AND ACHIEVEMENT

The civilization of Ceylon is more than 2,000

years old. Noteworthy among its achievements are those in architecture, painting, and engineering.

Art, Music, and Literature.—There are several ruined cities in Ceylon—notably Anuradhapura, the rock fortress of Sigiriya, Polonnaruwa, and Yapahuva, capitals at various periods from the 6th century B.C. to the 13th century A.D. They were well planned, ramparted, and moated. They had regular streets and surprisingly modern sanitation. Brick mounds, called dagobas (Sinhalese *dāgabas*), containing relics, were built in massive proportions. The largest, the 4th century Jetavana Dāgaba, at Anuradhapura, is over 250 feet high and has a diameter of 327 feet. Each dagoba is built on a platform, in a round or oval shape, with three rings, and a square on the summit, which is surmounted by a conical spire, capped by a gilded finial. About them are littered sculptured steps, balustrades, and door jambs. Some specimens of the stone sculpture and carvings rank among the finest in the world. There are also baths, rivaling Roman and Pompeian types, and what would today be called swimming pools. In addition, there are the remains of royal palaces, pavilions, and other buildings. All are in the dry zone, where the ancient kingdom flourished. The last of the Sinhalese capitals was Kandy, in the heart of the central mountain range. Architecture reached a very high standard, but gradually, during the period of decadence which culminated in the loss of independence in 1815, developed on folk lines now represented by the term Kandyana.

Under the stimulus of Buddhism the fine arts flourished. The classical period of Sinhalese art was between the 4th and 6th centuries A.D., and there were great revivals under royal patronage in the 11th, 13th, and 18th centuries. The finest paintings are those of the 5th century, represented by the celebrated frescoes of Sigiriya, still amazingly fresh. The next best known are the 12th century murals from the Tivanka image house at Polonnaruwa. Oils were used in very early times. Folk art is practiced in the Kandyana area, and well-preserved examples exist from the 18th century on. The tradition of architecture, painting, sculpture, music, handicrafts, and dancing has been continued by folk artists, with patronage from the Buddhist temples. The painting is flat and restful, resembling ancient Egyptian work. The treatment is narrative, and the object is repeated panel by panel. There is no true perspective. In handicrafts there is a tradition of fineness, fluency, and grace; the commonest objects—even kitchen utensils—are treated artistically. The Sinhalese have reached a high level of achievement in working with ivory, gold, silver, copper, brass, and wood. Most of the designs are traditional. The art of mat weaving and lacquer and filigree work is widespread in the villages.

Music, played by drums and flutes, is heard at village festivals, and at the annual festival held in connection with the Buddha's sacred tooth at the Daladā Mālagāwa in Kandy in August. At this time the best music and dancing native to the island is presented. There are many folk songs, and folk tales, replete with wisdom and a quaint sense of humor, are still told at village gatherings. While the theater is not highly developed, rural dramas, called *nadagam*, are played occasionally, and a movement to revive the drama on modern lines has been started. West-

ern motion pictures are popular, and Indian films attract large audiences. Sinhalese films made in India have revealed considerable talent.

Sinhalese, an Indo-Aryan language with many Dravidian words, dates from the beginning of the island's civilization and continues to be a medium suitable for expressing modern thought. Its literature, mainly religious, includes prose and poetry, philosophy, theology, and grammar of a high order.

Science and Technology.—The ancient Sinhalese excelled in engineering and irrigation. Vast artificial lakes, called tanks, dot the old kingdom. Most of them are being restored, and old water channels made to serve modern needs. The tanks were often built in chains, serving a series of villages before they reached their objective, the capital. The 5th century Jaya Ganga, the principal channel of the Kalaveva, is the best example of these old waterways. It takes water to Anuradhapura, 54 miles away; in its first lap of 17 miles the gradient is 6 inches to the mile. It is being used with levels intact. Minneri Tank, which covers about 4,500 acres, was built in the 4th century by King Mahasen. Modern counterparts are the Gal Oya project (see section on *Agriculture*) and the Laxapana hydro-electric project. The island has made great progress in scientific research. There is a medical research institute which has given Ceylon a leading position in the control of malaria and filaria. There are also research institutes for rubber, tea, and coconuts. The Department of Archaeological Survey carries on programs of excavation and conservation. Many valuable monuments have been preserved, and numerous important stone inscriptions discovered and published.

Education.—Primary and secondary education is controlled by the minister of education, and administered by the Department of Education. Primary education up to 11 years of age is in the mother tongue. Attendance is compulsory for children from 6 to 14 years of age. The schools are either run by the government, or, if conducted by organized religious denominations, aided by government grants. They are supervised by government inspectors acting under provincial education officers. Free education is the accepted policy, although a few older schools have been permitted temporarily to continue to charge fees. In 1948 there were 3,091 government schools, 3,146 assisted schools, and 623 English, central, and bilingual schools. The University of Ceylon, established on July 1, 1942 by the amalgamation of two colleges, has faculties of Oriental studies, arts, science, medicine, law, agriculture, and veterinary science; doctorates are given in letters, law, and medicine. Tuition is free. Courses are given in English. There are also industrial schools, polytechnic academies, and schools for the deaf and blind. Ceylon Technical College prepares students to the level of engineering degrees of the University of London. Adult education has made progress under a special education officer. There are a few public libraries maintained by local government bodies. The Department of National Museums administers Colombo Museum and other museums in the provinces. The attainment of dominion status stimulated the revival of indigenous arts and crafts, with full participation by the government. The Ceylon Society of Arts maintains an art gallery in Colombo, and in 1949 it organized the first of a series of art festivals. There is also

an active body, called the '43 Group, of modernist artists.

(G. P. M.)

HISTORY

The story of Ceylon begins traditionally in 543 B.C. (by an alternative system of chronology, 483 B.C.), with its colonization by the legendary Prince Vijaya. The most influential event in Ceylon's history, and the one which scholars generally make the starting point, was the Buddhist mission sent by Emperor Aśoka (r. c. 274–237 B.C.) of India to King Tissa at Anuradhapura.

Anuradhapura.—The Anuradhapura period of Ceylonese history lasted until the end of the 10th century A.D. In the 4th century a chronicle compiled from monastic records and known as the *Dipavamsa* related the history of Ceylon to the end of King Mahasen's reign (304 A.D.). A century later the better-known *Mahāvamsa* was compiled. It was continued from time to time, relating the story in 100 chapters to 1815. These two books constitute the chief source of the history of the island; they are often verified by inscriptions. They are written in Buddhist scriptural Pali verse (see INDIA, SUBCONTINENT OF—*Languages*). The greatest achievements of the Sinhalese were accomplished during the Anuradhapura period. The kings, though despots, were benevolent, and their rule was democratic to a considerable degree. Villages enjoyed a good deal of autonomy. The economy was agrarian, and cultural connections were largely with north India. The greatest ruler was Dutugemunu (Dutthagamani, r. 2d or 1st century B.C.), who is considered the savior of the island and its religion from Elala, a south Indian conqueror. In the 2d century A.D., King Gajabahu invaded south India and brought back many prisoners. Two centuries later there was a period of great vitality under the dynamic King Mahasen, builder of tanks, monasteries, dagobas, and other monumental structures. Under Kassapa (Kasyapa), of the 5th century, art flourished in its classic period. The island was known to Greeks, Romans, Egyptians, Arabs, and Chinese.

Polonnaruva.—At the close of the 10th century the Chola dynasty of southern India conquered the island, destroyed Anuradhapura, and made Polonnaruva its capital. When the Cholas were expelled by Vijayabahu I, in the mid-11th century, he continued their policy, and the city remained the capital for two centuries. The Polonnaruva kings, through political considerations, had more dealings with south India, and to this fact can be traced the distinct Dravidian-Hindu influences on the island's culture. Parakramabahu I the Great (r. 1153–1186), is the chief figure of this period. He unified the island, centralized its administration, and knit it together strongly as few of his predecessors had done. He showed great capacity for building and for making the island self-sufficient in food. He sent successful military expeditions to south India and Burma. Another energetic king was Nissanka Malla (r. 1187–1196). During the Polonnaruva period Ceylon was in touch with lands as far distant as Cambodia and China. Many Chinese coins and specimens of Sung pottery have been found in various places.

13th to 15th Centuries.—The fall of Polonnaruva in the 13th century was followed by a period of instability during which there were sporadic invasions from India, Malaya, and even China; capitals were moved from time to time;

and there was a marked trend toward the west coast. Parakramabahu II is the only powerful king of this period. His successors could barely keep the northern part of the island from breaking away into a separate kingdom under descendants of Tamil invaders, and they in fact ultimately established a kingdom of their own. Their power was checked in the 15th century by Parakramabahu VI. His capital was Kotte (near Colombo), the last capital of the traditional kingdom.

Portuguese and Dutch Rule; the Kingdom of Kandy.—In 1505 the Portuguese visited Ceylon, and in a few years, profiting by the weakness of the Kotte kings and the internecine warfare, were able to establish a hold on the maritime provinces which, confirmed by the Donation of Dharmapala in 1580, continued for 140 years. During this period the island had its first contact with European ways, with lasting effects. Roman Catholicism was introduced, and gunpowder was made known to the people, who also learned something of Portuguese language, dress, and music. Christianity was the chief contribution of the Portuguese. In 1638-1658, the Dutch drove the Portuguese from Ceylon. The Dutch United East India Company, with trade as its object, then took the place of Portuguese imperial rule in the maritime provinces. Meanwhile, the nationalist Sinhalese, resenting foreign influence in Kotte, left its King Dharmapala and the Portuguese to one side and established for a brief period the Kingdom of Sitawaka in the mid-country; it flourished under kings Mayadunne (r. 1521-1581) and Rajasingha I (r. 1581-1593). Upon the fall of Sitawaka in 1593, Sinhalese aspirations led to the formation of the independent highland Kingdom of Kandy, which in time came to control a large part of the island. (The Tamil kingdom in the north had already been destroyed by the Portuguese.) On several occasions Portuguese attacking Kandy were severely repulsed. Relations with the Dutch were better; they invaded chiefly to preserve their trade. In 1766, by the Treaty of Hanguranketa, King Kirti Sri (r. 1747-1782) of the Malabar dynasty (founded at Kandy in 1739) was forced to cede the entire seaboard to a depth of 4 miles to the Dutch. It was under this king that a great national and cultural revival took place. Meanwhile, the Dutch continued in control of the coast until 1796, when they were ousted by the British. The greatest contribution of the Dutch to the island was Roman Dutch law.

British Rule; the Dominion of Ceylon.—The British in their turn clashed with the Kandyan king, Sri Wickrema (Vikrama, r. 1798-1815), and his own people rose against him. In 1815 he was forced to abdicate and was deported to India, and the island went under British rule by the terms of a convention between the Sinhalese chieftains and the British governor. Three years later a serious rebellion almost drove the British out; there were other rebellions, in 1843 and 1848, but these were minor. The British introduced a colonial system of administration, and as the island became unified were able to bring about many useful changes. The country was opened up; coffee, tea, and rubber were introduced; coconuts were planted more extensively; and remote places were connected by road and rail. The opening of schools led to the gradual acceptance of English as the language of administration. The island was now brought into

line with European developments. Its special place in British strategy, as well as its importance to trade, was quickly realized. The people began to demand political advancement. Political reforms were introduced, culminating, on Feb. 4, 1948, in the end of British rule and the acquisition of dominion status. British occupation had resulted in steady progress. The lasting contribution of the British to the life of the island was parliamentary government. (G. P. M.)

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Authors of Sections:

(W. F. C.) WILLIAM F. CHRISTIANS,
Associate Professor of Geography, University of
Pennsylvania.

(G. P. M.) G. P. MALALASEKERA,
Professor of Pali, University of Ceylon.

CEZANNE, Paul, sã-zàn', French painter: b. Aix-en-Provence, Jan. 19, 1839; d. there, Oct. 22, 1906. The son of a banker, he did not have to contend with poverty despite the failure of his pictures to find purchasers for the greater part of his lifetime. He was a schoolmate of Émile Zola, who induced him to come to Paris in 1861. For a number of years Cézanne divided his time between Aix and Paris, where he came into contact with the best painters of his generation. Zola introduced him to Édouard Manet, and the young painter was soon acquainted with the group later called Impressionists, Pierre Renoir and Camille Pissarro being his particular friends. He exhibited with these artists in 1874, and again in 1877, when he submitted 17 paintings. Discouraged by the ridicule of the critics and by his differences with the Impressionists, Cézanne retired in 1879 to Aix, where he spent the remainder of his life. There he developed a style of great originality, which was to exercise a profound influence on the development of modern art. After a careful study of the old masters and an acceptance of the art of Eugène Delacroix and Gustave Courbet, he had next made himself master of the principles of their successors. This he did particularly during the two years (1873-1874) that he lived with Pissarro at Auvers-sur-Oise. But while the Impressionist ideas of light were his study during this period, he did not lose sight of the masters of the Louvre, and he made many experiments in applying latter-day knowledge to classic principles of design. In the early 1880's he was ready to begin a painting where personal inclination took on greater prominence as compared with inherited values. *L'Estaque*, at the Luxembourg in Paris, shows Cézanne on the road to his new style; the landscape (1888) at the Metropolitan Museum of Art in New York shows him firmly in possession of it. In his later years he went untiringly ahead, making clear to the next generation of painters that a profound conception of nature can be made by setting down a few essentials. His treatment of form and color rose to always greater heights. While most of his

works are still in private collections, he is represented, besides the museums noted above, in the Louvre, the Museum of Modern Art (New York), the Philadelphia Art Museum, and many other galleries. Cézanne's struggles and career are depicted in Émile Zola's novel *L'Oeuvre*.

A bold inaugurator, Cézanne was at the same time well aware of the great traditions of Western art and once summed up his goal succinctly as "de refaire Poussin d'après la nature" ("redoing Poussin after nature"). The fame and influence of Cézanne have grown enormously since his death. Though the humble master would have been the last one to countenance the idolatry later paid his work, the searching and experimental temper of his art helped undoubtedly to form the movements of post-Impressionism and Cubism, and it remains one of the strongest forces in modern painting.

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C.G.S. SYSTEM (CENTIMETER-GRAM-SECOND SYSTEM). See **UNITS OF MEASUREMENT** and **METRIC SYSTEM**.

CHABANEAU, shā-bā-nō', **Camille Jean Eugène**, French philologist: b. Nontron, Dordogne, France, March 4, 1831; d. there, July 22, 1908. A professor of Romance languages at Montpellier from 1879 until his death, he was a leading authority on Provençal philology and edited many old texts of the Languedoc. Besides contributing to the *Revue des langues romanes*, he wrote *Histoire et théorie de la conjugaison française* (1868); *Grammaire limousine* (1876); and *La langue et la littérature du Limousin* (1892).

CHABANEL, shā-bā-nēl', **Noël**, Jesuit missionary among the Huron Indians: b. near Menae, Lozère, France, Feb. 2, 1613; d. near St. Matthias Mission, Canada, Dec. 8, 1649. After entering the Jesuit seminary at Toulouse and teaching rhetoric in several colleges of the order, he was sent to New France (Canada) in 1643, where he studied the Algonquian language and labored as a missionary among the Indians until his death. The companion of his work was Father Charles Garnier; the story of their death at the hands of the Indians is recorded in the *Jesuit Relations* of 1649-1650. Chabanel and Garnier are among the group known as Jesuit Martyrs of North America, canonized by Pope Pius XI in June 1930.

Consult Wynne, J. J., *Martyrs of North America* (New York 1925).

CHABANNES, shā-bān', name of a noble French family from Limousin, particularly noted in the 15th century. Two of its best-known members were:

JACQUES DE CHABANNES (c.1400-1453), a French general during the reign of Charles VII, who served in the Hundred Years' War under Joan of Arc and participated in the Praguerie revolt (1440). Pardoned by the king he took a leading part in ousting the English from French territories.

ANTOINE DE CHABANNES, COMTE DE DAM-MARTIN. (c.1411-1488), Jacques's brother, also

combated the English and took part in the Praguerie. He presided over the tribunal that tried Jacques Coeur and later became a trusted servant of Louis XI.

CHABAS, shā-bās', **François Joseph**, French Egyptologist: b. Briançon, France, Jan. 2, 1817; d. Versailles, May 17, 1882. At first engaged in commerce, he began to devote himself to the study of hieroglyphics in 1851. His investigations centered chiefly on two periods of Egyptian history—the conquest of the country by the Hyksos, and the time of their expulsion. His principal work was *Mélanges égyptologiques*, 4 vols. (1862-1873). From 1873 to 1877 he edited *L'Égyptologie*, a journal.

CHABAZITE or **CHABASITE**, kāb'a-zīt, one of the zeolite (q.v.) minerals, generally definable as a hydrous silicate of aluminum, calcium, and sodium, with small amounts of potassium and occasionally of barium and strontium. It has a hardness from 4 to 5 and a specific gravity of 2.08-2.16. Though transparent, it varies in color from white to pale red or yellow and occurs in rhombohedral crystals as well as in amorphous forms. In North America it is found mainly in Nova Scotia, New Jersey, and Maryland.

CHABLAIS, shā-blē', historic Alpine region, France, now forming part of the Haute-Savoie Department. Lying south of Lake Geneva it encompasses the 5,000-foot limestone massif of the Savoy Alps. Cattle raising and cheese-making are the main industries. The chief town is Thonon-les-Bains. Chablais is a winter sports center, with the popular resort town of Évian-les-Bains. Together with Savoy, Chablais was ceded to France in 1860.

CHABLIS, shā-blē', Eng. shāb'lē, town, France, in the Department of Yonne, on the left bank of the Serein, 11 miles east of Auxerre. It stands in the midst of vineyards which produce the celebrated white Burgundy wine of the same name. In the town is the noted 12th century Gothic St.-Martin Church. Pop. (1946) 1,796.

CHABOT, shā-bō', **François**, French revolutionist: b. Saint-Geniez-d'Olt, Aveyron, France, 1759; d. Paris, April 5, 1794. In early life he entered the Capuchin Order, but later married the daughter of an Austrian banker and became a violent extremist. He was elected to the Legislative Assembly in 1791, and to the National Convention in 1792. On his motion, it is said, the Cathedral of Notre Dame was converted into the Temple of Reason. His rabid antimonarchist party was dubbed "Montagnards." Accused of bribery and fraud, he was arrested and guillotined at the same time as Danton.

CHABOT, Jean-Baptiste, French Orientalist and hagiographer: b. Vouvray, Indre-et-Loire, France, Feb. 16, 1860; d. Paris, Jan. 7, 1948. Educated at the seminary of Tours, at Louvain University, and at the Sorbonne, he was ordained to the priesthood in 1885, and for a time had charge of the department of missions in the Ministry of Public Instruction. In 1897 he was entrusted with an archaeological mission to Syria. Besides publishing numerous works on early ecclesiastical history and Orientalism, he



CEZANNE: Above: In "La meule" ("The Millstone") Cezanne transformed a pile of rocks and a forest into strong and lucid composition. Below: "Still Life With Apples." Cezanne painted apples particularly because their simple lines permitted him to concentrate on the problems which absorbed him most: form and color, space relations, and composition.

(Above) W. Idenstein & Co., Inc.; (below) Museum of Modern Art





bove: The self-contained composition of "Grande baigneuses" ("The Bathers") pointed a way to other painters.

eft: "Self Portrait," 1880—Cézanne once stated as his goal that he wished to achieve the "solidity and enduring quality of ancient art."

bove) Philadelphia Museum of Art; (left) Moscow Museum of Western Art; below) collection of Stephen C. Clark, New York

elow: "The Card Players" shows the artist's concern with developing the endless possibilities in form suggested by a subject—rather than the emotional significance of the subject's life.



was director of *Corpus scriptorum christianorum orientarium*, vols. 1-76 (1903-1914), and an associate editor of *Corpus scriptorum semiticorum*, issued by the Academy of Inscriptions and Belles-Lettres.

CHABOT, Philippe de (SEIGNEUR DE BRION; COMTE DE CHARNY; MARQUIS DE BUSANÇOIS), French soldier: b. about 1480; d. Paris, France, June 1, 1543. Having bravely defended Marseille in 1524, he was taken prisoner in 1525 by the forces of Emperor Charles V at the Battle of Pavia, where King Francis I was also captured. He was appointed admiral immediately after his release, and sent to Italy in 1529 to negotiate the ratification of the Treaty of Cambrai. As commander in chief in Savoy, in 1535, he effected the conquest of part of that country and of Piedmont. On his return to France charges of fraud were brought against him. He was found guilty and imprisoned (1541), but was soon afterward pardoned by Francis I, at the urgent solicitation of the duchesse d'Étampes, and reinstated in his position. Chabot is said to have been the first to suggest the project of colonizing Canada. His famous tombstone, probably sculptured by Jean Cousin, is now at the Louvre.

CHABRIAS, kā'brī-ās. Athenian general: d. Island of Chios, 357 B.C. He succeeded Iphicrates in the command of the Athenian forces before Corinth, in 392, defeated the Spartans at Aegina (388) and afterward assisted Evagoras I in Cyprus, and Acoris in Egypt, against the Persians. In 378 he led the army which the Athenians sent to the aid of Thebes against the Lacedaemonians (Spartans) under Agesilaus II, and saved his troops from impending defeat by a military stratagem renowned in antiquity, commanding them to await the attack of the enemy with pointed spear and shield resting on one knee. In 376 he won an important victory over the Lacedaemonian fleet off Naxos. Later he defended Corinth against Epaminondas. Chabrias took part in the expedition against Thrace at the outbreak of the so-called Social War, and fell in battle at the siege of Chios.

CHABRIER, shā-brē-ā', Alexis Emmanuel, French composer: b. Ambert, Puy-de-Dôme, France, Jan. 18, 1841; d. Paris, Sept. 13, 1894. He studied law at Paris and entered the government service, with music as an avocation, until 1880 when he began to devote himself entirely to his art. His work was strongly influenced by Richard Wagner. He composed the operas *Guendoline* (1886) and *Le roi malgré lui* (1887). Other works by him include *Dix pièces pittoresques* and *España*, an orchestral rhapsody, his first great success.

Consult Servieres, G., *Emmanuel Chabrier* (Paris 1912).

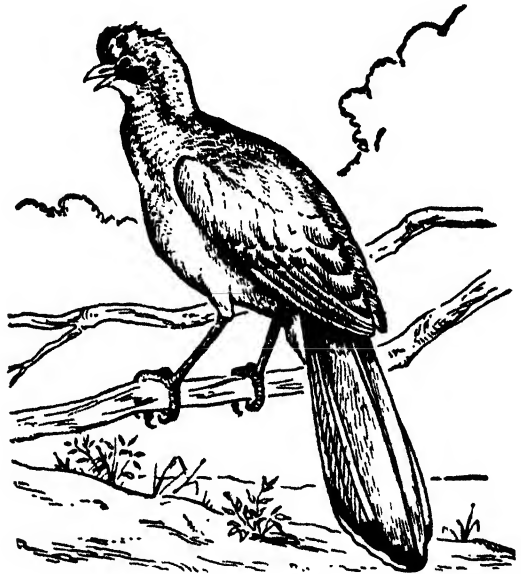
CHAC-MOOL, chāk-mōōl', the Maya rain god; also, according to tradition, a chief of the Maya Indians of Yucatán. In 1876 a statue was discovered in the ruins of Chichén-Itzá, Yucatán, which was thought to be a representation of Chac-Mool, and named accordingly. It is now in Instituto Nacional de Antropología e Historia, Mexico City, Mexico.

The term is also used to identify a certain type of reclining figure in ancient Mexican sculpture.

CHACABUCO, chā-kā-vōō'kō, town, Argentina, about 120 miles west of Buenos Aires. Founded in 1865, it is an important agricultural center. Pop. (1947) 12,917.

CHACABUCO, village and mountain pass, Chile, in Santiago Province, about 30 miles north of Santiago. It was the scene of a decisive victory (Feb. 12, 1817) of an Argentine-Chilean army under José de San Martín and Bernardo O'Higgins over the Spanish during the South American War of Independence. Pop. (1930) 684.

CHACHALACA, chā-chā-lā'kā, a fowl-like gamebird, *Ortalis vetula*, found from southern Texas to Central America. A slender bird, its body measures about twelve inches and the long tail another ten inches. The chachalaca is olive or greenish brown with large bare throat patches, which in the male becomes bright red in spring.



Chachalaca.

At morning and evening these birds assemble in the dense brush in which they live and cry very loudly, the syllables resembling *cha-cha-la-ca*. The trachea or windpipe, which has a long loop extending beneath the skin of the abdomen, doubtless adds to the volume of the sound which at times is almost deafening.

DEAN AMADON.

CHACHAPOYAS, chā-chā-pō'yās, city, Peru, capital of Amazonas Department, about 75 miles northeast of Cajamarca, situated on the eastern slopes of the Andes; altitude 7,638 feet. A bishopric, the ancient town on an Inca road goes back to an early pre-Columbian settlement. It was refounded in 1536 by the Spaniard Alonso de Alvarado. Gold, silver, and coal deposits are in the vicinity. Pop. (1940) 5,494.

CHACMA, chāk'mā, the Cape baboon's (*Papio porcarius*) Hottentot name. The males of this very large grayish-brown baboon of South Africa are about the size of an English mastiff. They roam around in large herds and cause considerable damage to cultivated crops. See also BABOON.

CHACO, chă'kō, Span. chă'kō, or EL CHACO or GRAN CHACO, region in South America, vast low-lying plain situated in the south-central part of the continent's interior and covering roughly 250,000 square miles. Divided between Paraguay, Argentina, and Bolivia, the long-disputed, though generally backward land is bounded in the east by the Paraguay and Paraná rivers (of the Río de la Plata system) and extends westward to the foothills of the Andes. (Sometimes adjoining parts of Brazil are also considered to belong to the Chaco.) In the north, at about 18° southern latitude, it merges with the tropical forests (selvas) of Bolivia, while its southern section, considered to terminate at the Río Salado of Argentina, is bordered by the Pampa.

Of a tropical to subtropical climate, the Chaco is sparsely populated and consists largely of semi-desert savannas and scrub forests. During the humid summer season large tracts are flooded, and the dry winter leaves them barren. Along the rivers lie good grazing grounds. So far of limited economic importance, the region's chief products are quebracho bark, from which tannin is extracted, timber (laurel, quebracho, carob, guaiacum, etc.), and cattle. Only the Argentinian section is now being energetically developed, and has become a valuable source of cotton. The Chaco's principal rivers, the Pilcomayo and Bermejo (Teuco), which traverse it in a southeasterly direction to join the Paraguay, divide it into the Chaco Boreal, the Chaco Central, and the Chaco Austral.

The CHACO BOREAL has been largely held by Paraguay since 1938, as a result of the Chaco War (q.v.). The Paraguayan section is divided into Presidente Hayes, Boquerón, and Olimpo departments. The western and northern fringes are in Bolivia—eastern parts of Tarija and Chuquisaca departments and southern Santa Cruz. It is believed that the sparsely settled Chaco Boreal will eventually support a much larger population.

The CHACO CENTRAL, ceded by Bolivia to Argentina in 1889, is situated between the Pilcomayo and Bermejo rivers, and consists of the national territory of Formosa and the northeastern section of Salta Province. It is adjoined by the CHACO AUSTRAL, a warm, predominantly humid area of northern Argentina comprising, besides the former Chaco Territory (Presidente Perón), parts of Salta, Santiago del Estero, and Santa Fé.

The former CHACO TERRITORY of the Argentine Republic, renamed PRESIDENTE PERÓN in 1951 when it was elevated to the status of a province, is bounded on the north, along the Bermejo, by the territory of Formosa, on the east, along the Paraguay and Paraná rivers, by Paraguay and the province of Corrientes, on the south by the province of Santa Fé, and on the west by the provinces of Salta and Santiago del Estero. Receiving in the 20th century a considerable influx of European immigrants, who were offered favorable terms by the national government, the province, once roamed by the native Indian population, has made great strides, producing cotton, its chief commercial crop, corn, citrus fruit, peanuts, tobacco, maté, jute, sugar cane, and sunflowers. Cattle raising, meat packing, lumbering (hardwoods), tannin extracting (from quebracho), and various processing industries based on the region's products are centered at Resistencia (1947 pop. 51,834), a rail and communication junction with river ports on the Paraná. The province

covers 99,633 square miles; pop. (1951 est.) 505,284.

CHACO CANYON NATIONAL MONUMENT, archaeological site, northwestern New Mexico, on the small Chaco River and in the Chaco Canyon, about 50 miles northeast of Gallup. Covering an area of 18,039 acres, it was established as a national monument in 1907. The extensive ruins, among which are 13 major pueblos of an advanced, probably 11th century A.D. civilization of Basket Maker and Pueblo Indians, are among the North American continent's leading pre-Columbian structures outside Mexico. The most imposing ruins are those of Pueblo Bonito, a village with five-story buildings backed by a sandstone cliff.

CHACO WAR, armed hostilities between Bolivia and Paraguay which raged from 1932 to 1935 over parts of the Chaco (q.v.) in the fork of the Paraguay and Pilcomayo rivers. A territory long disputed between the two nations, it was during the Spanish administration a part of the *audiencia* of Charcas, to which Bolivia had become the rightful heir. The latter, however, neglected the Chaco, while Paraguay opened it up to settlement and repelled the Indian tribes. It was only after the War of the Pacific (1879-1884), when Bolivia lost its access to the sea, that this nation turned its attention again toward the Chaco in order to seek an outlet on the navigable Paraguay River. With the discovery of rich petroleum wells in the western section, the region's great economic potential came to be fully realized by the two powers. A border incident broke out in 1929, but large-scale military operations did not start until 1932. Bolivia was successful at first, but both nations suffered a severe drain in manpower (sometimes estimated to have been as high as one million men killed and wounded), and Paraguay had gained the upper hand by 1935, when an armistice was concluded. The League of Nations, which had declared Paraguay the aggressor, tried to mediate, as did several Pan-American conferences but it was only in 1938 that the conflict was finally settled at Buenos Aires by the joint arbitration of Argentina, Brazil, Chile, Peru, Uruguay, and the United States. Paraguay was awarded approximately three quarters of the territory, while Bolivia kept the petroleum-bearing strip in the west and obtained permission to use Puerto Casado (to be linked with Bolivia by a corridor) on the Paraguay River as a free port.

CHACONNE, shă-kôn', Sp. CHACONA, an old and stately dance, in 3/4 time, probably of Spanish or Moorish origin. It was very popular in the 16th and 17th centuries. There are numerous examples of it in the instrumental and vocal works of Christoph Willibald Gluck, Johann Sebastian Bach, George Frederick Handel, Jean Philippe Rameau, and Henry Purcell. It is heard in Johannes Brahms' *Fourth Symphony*.

CHACORNAC, shă-kôr-năk', Jean, French astronomer: b. Lyon, France, June 21, 1828; d. Villeurbanne, near Lyon, Sept. 6, 1873. He worked at the Paris Observatory under Urbain Jean Joseph Leverrier, and discovered six asteroids while making ecliptic charts of the stars. His *Atlas éclipse* (1856) was continued by Paul Henry (1848-1905).

CHAD, chād (officially in French: TCHAD, chād), northernmost territory of French Equatorial Africa, extending northward as far as Libya and bounded on the east and west, respectively, by the Anglo-Egyptian Sudan and Niger, the latter a territory of French West Africa. Named for Lake Chad, on the southwest border, it has an area of approximately 495,750 square miles. Fort-Lamy, on the Chari (Shari) River in the southwest part of the territory, is the capital. Most of Chad consists of sandy desert, oases being few and far apart. At the northern end of the territory are the Tibesti Mountains, of which Emi Koussi (11,201 feet) is the highest point, and the Ennedi range, the highest peak of which has an elevation of 4,756 feet. The forested southern end is traversed by the Chari and its tributaries. French expeditions explored the area during the last decade of the 19th century, and in 1910, after native kingdoms had been subjugated, the Ubangi-Shari-Chad colony was established. Chad became a separate colony in 1920, and in 1946 it was constituted a territory within the French Union. Pop. (est. 1950) 2,238,200. See also FRANCE—Overseas Territories (Administration); and FRENCH EQUATORIAL AFRICA.

CHAD, Lake, northwest-central Africa, at the junction of the boundaries of French Equatorial Africa, French West Africa, and the northeastern end of Nigeria. The area is some 8,000 square miles during the rainy season, shrinking to less than half that size in dry weather. Although the lake is fed by the Chari (Shari) River and other streams, there is no visible outlet, and much water is lost by evaporation and percolation. Lake Chad was first seen by white men in 1823, when it was visited by Hugh Clapperton and Dixon Denham, British explorers.

CHADBOURN, chād'bērn, town, North Carolina, in Columbus County, about 50 miles west of Wilmington, N. C., and on the Atlantic Coast Line railway; it is a strawberry-shipping point. The town was incorporated in 1883. Pop. (1950) 2,103.

CHADDERTON, chād'ēr-t'n, urban district, Lancashire, northwest England, adjoining Oldham. An industrial town, it manufactures cotton goods, metalware, and pharmaceuticals. Pop. (1951) 31,114.

CHADDS FORD, chādz fōrd, village, Pennsylvania, in Delaware County, on the Brandywine Creek, where Washington was defeated (Sept. 11, 1777) by the British who then advanced to Philadelphia. See also BRANDYWINE, BATTLE OF THE.

CHADERTON, chād'ēr-t'n, Laurence, English Puritan divine: b. Lees Hall, Oldham, Lancashire, ?1536; d. Cambridge, England, Nov. 13, 1640. Converted to Protestantism while studying at Cambridge, he was later chosen master of the newly founded (1584) Emmanuel College, an office he held until 1622. A noted scholar of Latin, Greek, and Hebrew, as well as a popular lecturer at St. Clement's in Cambridge, Chaderton lived to an active old age in the full possession of his mental faculties. He is principally known for having served on the committee of Cambridge scholars who drew up the authorized version of the Bible (1607–1611).

CHADRON, shād'rūn, city, Nebraska, seat of Dawes County, about 50 miles north of Alliance and on the Chicago and North Western Railroad. It is situated in the Pine Ridge hills at 3,395 feet. There are railroad shops here; other economic activities include oil refining, flour milling, dairying, and trading in livestock. Chadron is the seat of the coeducational Nebraska State Teachers College, founded in 1911; nearby is Chadron State Park. The city manager plan of local government was adopted in 1950. Pop. (1950) 4,687.

CHADWICK, chād'wīk, Sir Edwin, English social reformer: b. Longsight, near Manchester, England, Jan. 24, 1800; d. East Sheen, Surrey, July 6, 1890. A lawyer by training, he early took an interest in municipal administration and sanitation problems. An article he wrote on police administration impressed Jeremy Bentham, and he became Bentham's collaborator. On Bentham's death in 1832, Chadwick was appointed to the Poor Law Commission. His report on child labor in factories led eventually to the adoption of the Ten Hours Act and the Employers' Liability Act. His investigation of public health conditions in London led to the establishment of the Board of Health in 1848, with Chadwick as a member. He was also responsible for the appointment of the first civil service commission in England, in 1855. He was knighted in 1889. His many writings were abridged and edited by Sir Benjamin Ward Richardson in two volumes, entitled *The Health of Nations* . . . (London 1889).

Consult Jones, D. D., *Edwin Chadwick and the Early Public Health Movement in England* (Iowa City 1931).

CHADWICK, French Ensor, United States naval officer and historian: b. Morgantown, Va. (now W. Va.), Feb. 29, 1844; d. New York, N. Y., Jan. 27, 1919. After graduating from the United States Naval Academy (then at Newport, R. I.) in 1864, he served aboard naval vessels, was an instructor at the United States Naval Academy, Annapolis, Md., and in 1882 was appointed naval attaché (the first American to hold such an office) in London. Later he was made chief of the Office of Naval Intelligence and the navy's Bureau of Equipment. During the Spanish-American War he became chief of staff to Admiral William Thomas Sampson and took an important part in the Battle of Santiago de Cuba (July 3, 1898). From 1900 until 1903 Chadwick was president of the Naval War College. Among his writings are *Causes of the Civil War, 1839–1861* (*American Nation Series*, vol. 19, 1906); *Relations of the United States and Spain, 1776–1898*, 3 vols. (1909–1911); and *The American Navy* (1914).

CHADWICK, George Whitefield, American conductor and composer: b. Lowell, Mass., Nov. 13, 1854; d. Boston, Mass., April 4, 1931. One of the most prolific American composers of his time, he had studied during 1877–1879 in Germany, and, following his return to the United States, was appointed organist of the South Congregational Church, Boston. In 1897 he resigned this post to become director of the New England Conservatory of Music, Boston, and he continued to head this institution until his retirement at the end of 1930. His many compositions for orchestra include three symphonies and the overtures: *Rip Van Winkle* (1879); *Thalia* (1883); *The Miller's Daughter* (1884); *Melpomene*

(1891); *Adonais* (1898); *Euterpe* (1906); and *Anniversary Overture* (1922). He was probably at his best in choral works such as *The Viking's Last Voyage* (1881); *Lovely Rosabelle* (1889); *Phoenix Expirans* (1892); and *Land of Our Hearts* (1918). His most ambitious works are a lyric drama, *Judith* (1900); the opera *The Padrone* (1915); and *Love's Sacrifice* (1917), a pastoral opera. Other works for the stage are the comic operas, *The Quiet Lodging* (1892) and *Tabasco* (1893). Chadwick also composed for piano and organ, and wrote a number of songs, besides several texts on musicology.

CHADWICK, Henry, American baseball pioneer and sports writer: b. Exeter, England, Oct. 5, 1824; d. April 20, 1908. He settled in the United States in 1837 and became a prominent sports writer for several Brooklyn and New York papers. Often called "the Father of American Baseball," he took a leading part in the evolution of the game. He drew up rules for it in the late 1840's, and from 1869 published an annual baseball handbook, later known as *Spalding's Official Base Ball Guide*. Chadwick's opinion that baseball originated in the old English game of rounders involved him in a dispute with his friend Albert Goodwill Spalding (q.v.), but he bequeathed his large collection of materials on baseball history to Spalding, who included it in the Spalding Baseball Collection now at the New York Public Library. Chadwick also wrote on football and cricket.

CHADWICK, Sir James, English physicist: b. Manchester, England, Oct. 20, 1891. After receiving his M.Sc. degree from Victoria University in Manchester, he worked in Ernest Rutherford's laboratory and in 1913 went on a scholarship to the Physikalisches-Technische Reichsanstalt in Charlottenburg, Germany, where he studied with the physicist Hans Geiger. At the outbreak of World War I he was interned at Ruhleben, Germany. At the end of the war, he joined Rutherford at the Cavendish Laboratory at Cambridge University, where he received his Ph.D. in 1921, and became a lecturer and assistant director of radioactive research. In 1932 he discovered the neutron by bombarding beryllium with alpha particles. (See ATOMIC THEORY—*The Atomic Nucleus*.) The same year he received the Hughes Medal of the Royal Society, of which he had been a fellow since 1927. In 1935 he was awarded the Nobel Prize in physics, and became Lyon Jones professor at the University of Liverpool.

During World War II he directed nuclear research on the British atomic project and worked at Los Alamos, N. Mex. Knighted in 1945 he was appointed scientific adviser and alternate delegate to Sir Alexander Cadogan—Britain's representative on the United Nations Security Council—and British representative on the Atomic Commission of the United Nations. In 1948 he became master of Gonville and Caius College, Cambridge. Among the many honors bestowed on him are the Copley Medal (1950) and the Franklin Medal of the Franklin Institute, Philadelphia (1951). Together with Lord Rutherford and Sir Charles Drummond Ellis, Chadwick wrote *Radiation from Radioactive Substances* (1930); a revised 4th edition appeared in 1953 under the title *Radioactivity and Radioactive Substances*.

CHAEREA, kêr'ê-â, Gaius Cassius (some-

times called *Cassius Chaerea*), Roman soldier and conspirator: executed Jan. 25, 41 A.D. While a tribune in the Praetorian Guard he was mocked by the emperor, Caligula, for his high-pitched voice and supposed effeminacy. This insult is considered the chief reason for his plot against Caligula. During the Palatine games, on Jan. 24, 41 A.D., the emperor was walking to the circus when he was stabbed by Chaerea and Sabinus another tribune. The guard then proclaimed Claudius emperor, but Chaerea and some of the other conspirators were sentenced to immediate execution.

CHAEREMON, kê-rê'môn, a 4th century B.C. Athenian tragic poet, whose *Centaurus* is mentioned in Aristotle's *Rhetoric*. A few fragments of his writings survive.

CHAEREMON, a 1st century A.D. Alexandrine Stoic philosopher and author, who in 49 A.D. went to Rome as tutor of the young Nero. He wrote historical works on Egypt, and various treatises on astrology, religious cults, hieroglyphics, and grammar, but virtually none of his work has been preserved.

CHAERONEA, kêr-ô-nê-â, an ancient Greek town (now CHAERONEIA) in western Boeotia, west of Lake Copais and southeast of Mount Parnassus, near Orchomenus. It stands at the head of the last defile where a stand could be made against an invader of central Greece; and is famous as the birthplace of Plutarch, the Greek biographer, and as the scene of two great battles.

In 338 B.C. Philip II of Macedon, assisted by his son Alexander, here defeated the united forces of the Athenians and Thebans (or Boeotians), and thus crushed the liberties of Greece. Excavations near the modern village have unearthed a well-preserved theater and pieces of a gigantic lion commemorating the spot where the Thebans fell. The lion was re-erected in 1905.

In 86 B.C. the Roman general Lucius Cornelius Sulla (q.v.) defeated the generals of Mithridates VI, king of Pontus, at Chaeronea. Sulla claimed to have lost only 15 men in the battle.

CHAETODONTIDAE. See BUTTERFLY FISHES.

CHAETOGNATHA, kê-tôg'nâ-thâ, a phylum and class of marine worms, also called arrow worms. See ANIMAL CLASSIFICATION; and NEMATHELMINTHES.

CHAETOPODA, kê-tôp'ô-dâ, a class of worms belonging to the phylum Annelida, characterized by segmentation and the almost invariable possession of bristles (*chaetae*), usually four bundles to a segment. They comprise the earthworms, the leeches, certain fresh-water and numerous marine annelids, such as the lugworm, *Serpula arenicola*, and many other genera. The most common and one of the largest American chaetopods is the clamworm (*Nereis virens*), which is associated with the clam of the New England coast, burrowing deeply in the mud. The marine forms undergo a metamorphosis, hatching as top-shaped, free-swimming larvae, called trocophores. Some of the forms, as *Nais*, *Syllis*, and *Autolytus*, also multiply by a process of self-division called strobilation, and by alternation of generations. Some of them, as *Serpula* and *Spiro-*

bis, live in solid calcareous tubes or shells. Certain forms are luminous. The tracks of chaetopod worms occur in Cambrian strata, and are so much like those made by existing forms that it is evident the type has undergone little change since the Cambrian period, which lies at the very base of the Paleozoic Age. Sometimes practically all the Annelida are known as Chaetopoda. See also ANNELIDA or ANNULATA.

CHAETOPTERUS, kē-tōp'tēr-ūs, a genus of sedentary, marine polychaete worms of the phylum Annelida which live in secreted U-shaped tubes that are open at both ends. Water is drawn through the tubes by modified parapodia, so-called fans.

CHAFARINAS, chā-fā-rē'nās, or **ZAFARIN ISLANDS**, zāf'ā-rin, (sometimes also spelled CHAFFARINAS), a group of three small Spanish islands, off the coast of Spanish Morocco in the Mediterranean Sea, 27 miles east-southeast of Melilla, from which they may be reached by boat.

Called Tres Insulae by the Romans and Zafran under Arab rule, the islands were the haunt of Barbary pirates until 1848 when they were annexed by Spain. Congreso, the largest island, rocky and hilly, has an observation tower. A great landlocked harbor, sheltering the largest ships, has been created by a breakwater uniting the central island, Isabel II, with Rey nearby. Isabel II is the only inhabited island, with about 300 inhabitants, including a garrison. The islands belong administratively to Málaga.

CHAFER, chāf'ēr, the name for several kinds of beetles, but particularly for members of the family Scarabaeidae. The name is apparently derived from the German *Käfer* (beetle). The widely distributed rose chafer, *Macrodactylus subspinosus*, attacks the flowers and foliage of roses, grapes, and other plants, while the larvae live on the roots.

CHAFFEE, chāf'ē, **Adna Romanza**, American soldier: b. Orwell, Ohio, April 14, 1842; d. Los Angeles, Calif., Nov. 1, 1914. He began his military career in the Civil War (1861) as a private, and was rapidly promoted for efficient service, being commissioned 2nd lieutenant in 1863 on direct order of Secretary of War Stanton. He was wounded twice, and captured in the Gettysburg campaign, but he refused parole and escaped. His commanding officer persuaded him to remain in the army at the close of the Civil War, and in the next 25 years he served in the Southwest, acting at times as Indian agent. In the Spanish-American War, in 1898, he was given a brigade and distinguished himself in the engagement at El Caney, whereupon he was promoted major general of volunteers. He served as chief of staff to the military governor of Cuba from December 1898 to May 1900. He was sent to China during the Boxer Rebellion to command the United States troops at Peking. In 1901 he became a major general in the regular army and took over the command of the Division of the Philippines. Advanced to lieutenant general and chief of staff of the army in 1904, he retired in 1906.

CHAFFEE, **Adna Romanza**, United States army officer: b. Junction City, Kans., Sept. 23,

1884; d. Boston, Mass., Aug. 22, 1941. Son of the preceding, he graduated from West Point in 1906 and finished his training in Cuba, where he became one of the outstanding horsemen in the army. He graduated from the Saumur cavalry school in France in 1912, and served in World War I in the Saint-Mihiel and Meuse-Argonne offensives, winning the Distinguished Service Medal. On the basis of his experience in the war he urged the War Department to equip the army with tanks and tractor-drawn trucks, and in 1934 organized the United States Army's first mechanized brigade. In August 1940 he was made a major general.

CHAFFEE, chāf'ē, city, Missouri, in Scott County, about 100 miles south-southwest of St. Louis; served by the Chicago and Eastern Illinois, and the St. Louis and San Francisco railroads. It is a center of trade in agricultural products, and of textile and leather goods manufacture. The city was incorporated in 1906. Pop. (1950) 3,134.

CHAFFINCH, chāf'inch, a familiar Old World songbird (*Fringilla coelebs*) of the finch family, very common in England and throughout Europe, but also occurring in some parts of Asia and in North Africa and the nearby Atlantic islands. It is about six inches long. The female is inconspicuously colored but the male is very handsome with a bluish head, reddish cheeks, pinkish breast, chestnut back, and black wings with striking white bars. In addition to its beauty, this very popular bird has a confiding nature and quickly becomes friendly to the point of tameness. It is a favorite cage bird in Europe, valued for its beauty, its gaiety, and its loud and cheerful song, which is susceptible of training. See also FINCH.

DEAN AMADON.

CHAFIN, chāf'in, **Eugene Wilder**, American prohibitionist and politician: b. East Troy, Wis., Nov. 1, 1852; d. Long Beach, Calif., Nov. 30, 1920. He studied law and practiced in Waukesha, Wis., from 1876 to 1900, when he moved to Chicago and served as superintendent of the Washington Home for Inebriates from 1901 to 1904. He became known as an eloquent speaker and an active organizer in the temperance and prohibition movements, and was the Prohibition Party candidate for several public offices, notably for governor of Wisconsin in 1898, and in 1908 and 1912 for the presidency of the United States. In 1909 he was admitted to the bar of the United States Supreme Court. His published writings include *Lives of the Presidents* (1896); *Lincoln; the Man of Sorrow* (1908); *Washington as a Statesman* (1909); and *The Master Method of the Great Reform* (1913).

CHAGALL, shū-gāl', **Marc**, Russian painter: b. Liozno, near Vitebsk, Belorussia, July 7, 1887. As a youth, he worked as a photo-retoucher in his native town until, when 20 years of age, he ran off to St. Petersburg (now Leningrad) to study painting seriously. Soon tired of the formalism taught in the academic art schools of the capital he enrolled with Léon N. Bakst, who was then connected with the Diaghilev Ballet. Though his highly imaginative scenic designs were rejected for their extravagant flights of fancy, Bakst agreed to take him to Paris with

the ballet company in 1910. Here Chagall immediately felt at home. Cubism, a strong new force in French art, acted upon him as a liberating influence, though he was not committed to this or any other school of painting, but to his own visionary temperament alone. He gave full vent to the whole range of his exuberant palette and the childlike, mystical, grotesque imagery evoked by his memories of Russian-Jewish village life. His canvases of floating people, humanized animals, and ecstatic physical objects—defying the law of gravity and the customary standards of realism—seemed to recreate the magic spirit of eastern folklore. It was Chagall's aim to remake or rather parallel nature, and when he held his first exhibition in 1914 at Berlin, his art was hailed by Guillaume Apollinaire as "supernatural" (or surrealist). For similar reasons Chagall has been called a forerunner of German expressionism and Italian futurism.

Following this first success, Chagall returned for a visit to Russia when World War I broke out, and had to stay there for the war's duration. After the October Revolution in 1917, he founded with Soviet support an art school and museum at Vitebsk, where he also acted for a while as minister of art. Besides several magnificent portraits of rabbis, he did murals for the Granowsky Jewish State Theater, and painted sets for the great productions of the early Soviet stage. But his modernistic art met with increasing disfavor from the new masters of Russia, whose tastes reverted to the representationalism of traditional Western painting. In 1923 he returned to Paris and took out French citizenship. It was then that he executed, upon the commission of Ambroise Vollard, his famous book illustrations for the *Fables of La Fontaine*, Gogol's *Dead Souls*, and the Bible.

The defeat of France in 1940 forced Chagall to take refuge in the United States, where he resided from 1941–1948. Here he resumed his creative activities by designing ballet sets and costumes for Léonide Massine's *Aleko* and Igor F. Stravinsky's *Fire Bird*. During this period he painted his *Descent from the Cross* (Museum of Modern Art, New York), and many other intense pictures which left an indelible imprint on modern American art. Among Chagall's best-known paintings in American museums are *The Rabbi of Vitebsk* (Art Institute, Chicago) and *I and My Village* as well as *Birthday* (Museum of Modern Art, New York).

The artist returned to Europe in 1948, and settled at Vence in the south of France. The same year he won the International Prize for Engraving at the Venice Biennale. The Salle Chagall at the Musée d'Art Moderne in Paris was inaugurated in 1950.

Consult Chagall's autobiographical *Ma Vie* (1931); Venturi, Lionello, *Marc Chagall* (New York 1945); Sweeney, J. J., *Marc Chagall* (New York 1946); and Kloomok, I., *Marc Chagall: His Life and Work* (New York 1951).

CHAGAS' DISEASE, shá'gás, an acute or chronic disorder, known also as South American or Brazilian trypanosomiasis (q.v.). It was first described in 1909 by Carlos Chagas (1879–1934), a Brazilian physician. It is caused by *Schizotrypanum* (or *Trypanosoma*) *cruzi* and transmitted to man by biting bugs. It is a fatal disease, marked by fever, myxedema, and enlarged lymph glands, spleen, and liver; and later by symptoms referable to the heart, endocrine glands, and nerv-

ous system. There is no known effective treatment.

HAROLD WELLINGTON JONES, M.D.

CHAGOS ISLANDS, chā'gōs (sometimes called OIL ISLANDS), a group of British-owned islands in the Indian Ocean, a dependency of Mauritius (q.v.), about 1,200 miles northeast of that island and about 250 miles south of the Maldives Islands. The group consists of five main coral atolls, with its center at latitude 6° 0' S and longitude 72° 0' E. However, Diego Garcia, largest member of the archipelago—about 2½ miles long and 6 miles wide—is 100 miles to the southeast. This island is crescent-shaped and consists of a coral atoll covered with cocoa palms, enclosing a lagoon that forms a harbor. During World War II it served as a British air base. The two other inhabited islands are Peros Banhos and Salomon; the uninhabited are Three Brothers and Six Islands. The surrounding waters teem with fish, and excellent green turtle are found on the shores. Coconut oil is the chief product, and copra, coconuts, fish, and guano are also exported. Pigs and poultry are raised. Pop. (1944) 1,048.

CHAGRES, chā'grís; Span. chā'grás, a river and village in the Panama Canal Zone. Founded at a site discovered by Columbus, the village (1950 pop., 210) stands at the Atlantic (Caribbean) mouth of the river, about 6 miles west-southwest of Colón. In the colonial period, it was the principal Atlantic port of the isthmus, but it is now of little significance. The river, which rises in the Republic of Panama (Cordillera de San Blas), is today largely merged with the Panama Canal and, particularly, Gatun Lake. See also PANAMA—*Chagres River*.

CHAGRIN FALLS, shā-grín', village, Ohio, Cuyahoga County, altitude 985 feet, on the 45-mile-long Chagrin River. It is served by the Wheeling and Lake Erie railroad, and is 16 miles by highway east of Cleveland. A largely residential community, with a mayor and council form of government, it also manufactures paper, chemicals, pharmaceuticals, electrical goods, and machinery. Pop. (1950) 3,085.

CHAHAR, chā'hār' (Chinese CH'Á-HA-ERH), formerly one of China's northern provinces. It was bounded on the north by Inner Mongolia, west by Suiyuan, southwest by Shansi, southeast by Hopeh, and east by Jehol. Lying mainly between two sections of the Great Wall, in the drainage basin of two rivers, the region is on a traditional trade route between China proper and Mongolia, on the Peking-Suiyuan railroad. Agriculture, stock raising, and coal and iron mining are also important. Kalgan (Wanchüan), formerly the capital, and Tatung, both on the railroad, are the two chief cities in the area; Tolum is a caravan center.

In 1914, Chahar was formed as a Mongol administrative area in the Mongolian Chahar League; in 1928 it became a full province. During the Sino-Japanese War, Chahar was occupied by the Japanese (1937–1945) and was a part of their Mongolian puppet state. In 1949 the Chinese Communists, who had gained control after World War II, made boundary changes in order to include a section of Chahar in the Inner Mongolian Autonomous Region. Chahar then included a northeast section, once part of Chihli Hopeh, and

a southwest section taken from North Shansi. It covered approximately 45,000 square miles; pop. (est. 1940) 3,500,000. The province was reported abolished in November 1952, along with Pinkiang Province, and partitioned among other provinces of North China.

CHAILLE-LONG, shá-yá'lǒng', Charles, United States soldier, diplomat, and explorer: b. Princess Anne, Somerset County, Md., July 2, 1842; d. Virginia Beach, Va., March 24, 1917. He attended Washington Academy in 1860, and enlisted in the Union Army in 1862, rising to the rank of captain. After the Civil War he joined (1869) the Egyptian Army as a lieutenant colonel, and was chief of staff to Gen. Charles George Gordon ("Chinese Gordon") in 1874-1877, while Gordon was engaged in suppressing slave traffic in the White Nile region. The khedive entrusted Chaillé-Long with a secret mission to the king of Uganda, and while on this mission, he carried out important explorations in the upper Nile basin. His experiences were told in his book: (*Central Africa: Naked Truths of Naked People* (1876)).

Returning to the United States, he took a law degree at Columbia University in 1880, and practiced in Alexandria, Egypt, acting there as United States consul general after the revolt of June 11, 1882. He later became consul general and secretary of the legation in Korea (1887-1889); secretary of the Universal Postal Congress, Washington, D.C., May 1897; and chargé d'affaires (October 1897-September 1898) of the special commission to the Paris Exposition of 1900. In 1910 he was awarded a gold medal by the American Geographical Society for his part in the final solution of the problem of the Nile sources. Chaillé-Long published in both French and English. Some of his works are *The Three Prophets: Chinese Gordon, Mohammed-Ahmed (El Maahdi), Arabi Pasha* (1884); *Les sources du Nil* (1891); *L'Égypte et ses provinces perdues* (1892); *La Corée ou Chosen* (1894); *Les provinces équatoriales d'Égypte* (1904); and *My Life in Four Continents* (1912).

CHAILLU, Paul du. See DU CHAILLU.

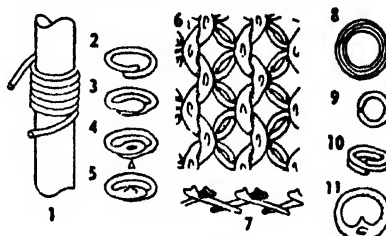
CHAIN, English chān, **Ernst Boris**, German-born, naturalized English biochemist: b. Berlin, Germany, June 19, 1906. Educated in his native city, he became a refugee from Nazism in 1933, and went to Cambridge, England, to join Sir Frederick Gowland Hopkins in research on enzymes and the isolation of biologically active substances. In 1935 he became a member of the faculty of the Sir William Dunn School of Pathology at Oxford, and in 1938 collaborated with Professor H. W. (later Sir Howard Walter) Florey at Oxford on a systematic investigation of antibiotic substances produced by bacteria and molds. This all-important work laid the foundation for the discovery of the chemotherapeutic properties of penicillin and Chain's discovery of penicillinase. With Sir Alexander Fleming and Florey he shared the Nobel Prize for physiology and medicine in 1945. Many other international medals and awards followed. After World War II, Dr. Chain became scientific director of the international research center for chemical microbiology in the Istituto superiore di Sanità, Rome, Italy. He was made a fellow of the Royal Society in 1949.

CHAIN ARMOR. See CHAIN MAIL.

CHAIN BRIDGE. See BRIDGE.

CHAIN CABLE. See CABLE.

CHAIN MAIL (more properly, "mail"), flexible armor of interlinked metal rings; also called chain armor, mail armor, and linked armor. The form and size of the rings, and the method of interlinking them, vary. In most European examples each link is riveted and passes through four others, the average ring being less than half



Method of making chain mail: Wire coiled around a cylinder (1) is cut into rings with overlapping ends (2) which are flattened (3), punched for a rivet (4), and riveted (5); typical riveted mail mesh (6) and section (7); stamped ring without joint (8); butted ring (9); coiled link (10); and link with cusped inner diameter (11).

an inch in outside diameter. However, there are examples with each ring linked through six others (rare); some with large and small rings in alternate rows (certain of the early Gaulish fragments are of this order); and many examples in which rows of solid rings, stamped out in one piece, alternate with rows of welded or riveted



Left: Chain mail as represented on Trajan's column (114 A.D.). Top right: English warrior (King Harold?) from Bayeux Tapestry wearing mail hauberk at Battle of Hastings (1066). Bottom right: Arming coif of quilted fabric worn under mail hood (From Maciejowski MS, mid-13th century).

rings. In some meshes (the so-called "double-mail") the rings are formed of heavier wire, thus diminishing their inside diameter sometimes to such an extent that even the point of a pin will not penetrate.

Mail was in use in Western Europe centuries before the Crusades but, except for scattered archaeological finds, examples earlier than the

Robinson-Patman Act, passed in 1936, was aimed specifically at monopolistic practices in distribution. Simultaneously, many independent enterprises have formed among themselves so-called voluntary chains, in which separately owned and managed stores pool their resources in such activities as joint wholesaling, buying, or promotion; and consumers have formed profit-sharing consumer cooperatives, which, particularly in European countries, often consist of large chains (see COOPERATIVE MOVEMENT).

The operation of more than one store has been considered by some students to constitute a chain, but it has been contended that some characteristics typical of chain store operation, especially in the food field, do not become operative until there is a minimum of four stores under a single ownership and operation. In spite of great changes in the size of stores, the key difference between independent operations and chain operations remains the number of stores under common ownership and management. Added stores mean added volume and the ability to warehouse merchandise sold in the retail outlets, instead of purchasing from a wholesaler; ability to purchase in larger quantities and to transfer merchandise to retail stores without the necessity of maintaining salesmen, or of dividing volume with two or more other wholesalers; ability to advertise jointly for a group of retail outlets; and ability to secure and use the services of experts in various fields, such as personnel selection and training, record controls, site selection, store design and layout, and so forth, and spread the fees commanded by these experts over a number of units. The result then is, besides greater efficiency, reduced prices because of lower costs and elimination of extra profits by the middleman.

History.—Chains of the retail distribution type have been found by historians as far back as ancient Rome and in China about 200 B.C. Chains were part of the commercial system of 17th century Japan, Germany, and England. In America, the Hudson's Bay Company, chartered in 1670, operated a famous chain of trading posts. This was the earliest chain known to have operated on this continent. Andrew Jackson at one time owned a small chain of retail stores in Tennessee. However, the first major development of the modern chain store in the United States began in 1859, when George F. Gilman and George H. Hartford opened a store for the sale of tea, coffee, and spices which they purchased as importers on the theory that they would eliminate some intervening costs and therefore be able to sell this merchandise at lower prices to customers. They found that this idea as practiced by their company, the Great American Tea Company, worked out as anticipated, and it was not long (1865) before they had expanded their operations to sell other grocery items in their chain which had grown to 25 stores. This, then, was the beginning of what became in 1869 the Great Atlantic and Pacific Tea Company, which in 1930 operated a peak number of 15,700 stores.

Chain stores soon were introduced in the clothing, book, cake, and restaurant fields, and for a great variety of other goods and services. In the following will be discussed three of the most representative types of chains: FOOD CHAINS, VARIETY CHAINS, and DRUG CHAINS.

FOOD CHAINS

The rise of the chain system in the United

States was closely linked with the development of food chains. The Great Atlantic and Pacific Tea Company was followed by such other multiple stores as the Grand Union Company (originally Jones Brothers Tea Company, 1872, New York); the Kroger Company (1882, Cincinnati); The American Stores Company (1886, Pennsylvania); H. C. Bohack Company (1887, New York); Gristede Brothers (1891, New York); First National Stores (1895, Boston); National Tea Company (1897, Chicago); Jewel Tea Company (1899, Chicago); Henke & Pillot (1872, Houston); Ralph's (1873, Los Angeles); Daniel Grocer Company (1882, Murphysboro, Ill.); and F. W. Albrecht Company (1891, Akron).

Legislation.—Nevertheless, in the food chain field, the period until the turn of the century was one of sporadic development. In the early years of the 20th century there was a substantial growth both in the number of food chain companies and in the number of stores operated. A little later, in the decade 1920 to 1930, there were a series of efforts to penalize the new chain store method of distribution by legislative measures. Anti-chain store tax laws were introduced in a number of state legislatures beginning in 1923, and at one time 29 states had discriminatory taxes against chains. In the 1930's the food chains launched an attack against anti-chain store tax proposals by presenting their case to the public, and the tide began to turn. Several of the discriminatory laws were declared unconstitutional, and in 1936 a California discriminatory tax was rejected by a referendum vote. Other states repealed similar tax laws until in late 1953 only 15 state anti-chain store tax laws remained in effect.

Profits.—Food chains, in 1953, operated with an average margin of about 18 per cent based on sale price. This covers warehousing and delivery, office operations, buying, advertising, and overhead, as well as all store labor, rent, light, heat, supplies, and other expenses. Average operating profit before taxes was reported by the National Association of Food Chains as 2.20 per cent for 1952, with estimated profit after taxes at an average of 1.0 per cent.

Supermarket and Self-Service.—A new development in food distribution, which began in the early 1930's with independent food stores, was quickly taken up by food chains and extended rapidly. This was the development of the so-called supermarket. As early as 1916, Clarence Saunders of Memphis, Tenn., conceived the idea of self-service in food stores on a broad scale. Isolated examples of self-service had appeared before this time, but the Piggly-Wiggly system developed by Mr. Saunders started self-service on its remarkable career. The system was built around a plan using turnstiles and guardrails which directed traffic past displays of merchandise on shelves and gondolas (tables) and then past check-out stands complete with cash registers. Early self-service stores generally limited the self-service feature to the dry grocery department.

The depression period of the early 1930's gave great impetus to the development of self-service and to the building of larger markets, with wider lines of merchandise, lower prices, free parking, a minimum of service features, and larger volume. Beginning about 1947, self-service was extended on a major scale to the meat department with pre-packaging of consumer meat cuts in transparent wrapping film. Pre-packaging of meat is done at the store in nearly all cases, although experiments

in centralized pre-packaging of meats are currently in progress. Pre-packaging of produce has been adopted almost universally for such items as tomatoes and spinach, and quite generally for potatoes, apples, oranges, carrots, and other fruits and vegetables, although many stores offer these items both pre-packaged and in bulk.

General Characteristics.—Some major features of chain food stores include: one price system—that is, all merchandise is marked so that each customer pays the same price for the same item; cash and carry, rather than credit and delivery; self-service, which is now being extended in many larger stores to dairy products, meats, and produce, as well as grocery items; full lines of merchandise, including some household items, which make possible so-called one-stop shopping; vastly improved sanitation, both in store and merchandise; parking facilities. Although all of these features are not available in all outlets of every chain, they are characteristic of the system as a whole.

Warehouse efficiencies, newly developed by food chains, include extensive use of mechanization in the physical handling of merchandise (fork-lift trucks, pallets, towlines, industrial tractors, and similar devices), and mechanization of accounting systems, including mechanical and electronic punch-card systems.

The percentage of retail food stores business done by food chains has remained relatively stable since 1933 when it was estimated that retail food chains did 38 per cent of the food store business. During the war years when food products were rationed, food chain percentage dropped, but for 1953 it was estimated by the National Association of Food Chains that the share was approximately 39 per cent. Leveling off of the percentage of total retail business done by food chains is due in major part to the great improvement in services rendered by the wholesaler-independent retailer system, and the development of cooperative chains and voluntary chains which have resulted in the adoption of many of the new methods developed by chains. Increasing numbers of single large-volume supermarkets have helped to maintain the independent share of total retail food store volume, but many successful single store operators open additional stores and thereby move into the chain store classification.

Reasons for the success of chain food stores were recently investigated by the National Association of Food Chains. Factors stressed by homemakers were: lower prices; wide variety; convenient location; courteous service; fresh, dependable merchandise; and cleanliness.

The influence of the American food chain system of distribution is being felt in other countries notably in Europe and South America, as a result of visits to the United States by operators of foreign food chains.

The concentrated merchandising ability of food chains has been used to relieve the pressure of agricultural surpluses by featuring plentiful foods as a service to both producer and consumer—and as good business for the chains. In 1936, the first nationwide campaign to sell farm surpluses was inaugurated by the National Association of Food Chains with 34,000 cooperating food stores giving special merchandising aid to peaches. Results were so startling that this became the forerunner of about 300 similar organized sales efforts. This organized program, which utilizes the united mass merchandising technique of food chains, was de-

veloped in a series of conferences between representative farm leaders and food chain executives through the machinery of the National Association of Food Chains.

Lower cost food distribution through chain stores has not only contributed to an improved standard of living but has made possible an expansion of food production with far-reaching effects. New products can be introduced much more rapidly with food chain advertising support based on the industry's expenditure of an estimated \$150 million a year in newspaper, radio, and television promotions. The impact of display in hundreds or even thousands of outlets at a time gives worthy new products a fast start toward consumer acceptance. Vast increase in use of refrigeration has extended the market for perishable products and made seasonal items available, in some cases, the year around.

JOHN A. LOGAN,
President, National Association of Food Chains.

VARIETY CHAINS

Frank W. Woolworth (q.v.) is generally credited with being the pioneer of the five and ten cent store. There is considerable evidence that several other men had experimented with the same idea even before Woolworth tried his one-price plan while working as a clerk in Augsburg & Moore's Dry Goods Store, Watertown, N. Y. But few dispute the fact that it was Woolworth who perfected this new concept of retailing, and did more than any other individual to popularize the variety store of today.

The success of five and ten cent stores has been due largely to the great variety of inexpensive, fixed-price merchandise made available; attractive presentation in open displays; top retail store locations; and the experience of shoppers that they get their money's worth.

Expansion.—Frank Woolworth opened his first successful five and ten cent store in 1879 at Lancaster, Pa. The five and ten idea expanded gradually in the beginning, gathering momentum as the new type of merchandising became more and more popular with the public. Following Woolworth, the McCrory Company started in 1881, S. H. Kress in 1896, S. S. Kresge in 1897, W. T. Grant and G. C. Murphy in 1906, Neisner Brothers in 1911, J. J. Newberry in 1912, and McLellan in 1913. The H. L. Green Company came into the field in 1932 as a consolidation of the profitable stores of the F. & W. Grand Stores (in business since 1901), the Metropolitan Chain Stores, I. Silver Brothers, and the F. & W. Grand-Silver Stores. The limited price variety store chains, or syndicate stores as they were originally called, had developed at a steady rate up to the World War I period.

Their greatest expansion to date came during the war years and through the prosperous 1920's. The companies named above, all of which started out as the ventures of independent merchants, operated the following numbers of stores in 1931, the year in which new store openings began to level off: Woolworth, 1,903; Kresge, 711; McCrory, 244; Newberry, 379; McLellan, 278; Neisner, 78; Murphy, 172; Grant, 404; and Kress, 221. As of the date of consolidation in 1932, the H. L. Green Company was operating 133 stores, which advanced to 182 by the next year and then remained relatively constant. Since 1931, expansion in respect to number of stores has been gradual for most companies.

CHAIN STORES

OUTLETS AND SALES OF VARIETY CHAINS

	Stores		Sales	
	1931	1952	1931	1952
F. W. Woolworth Co.	1,903	1,960	\$282,669,576	\$712,600,880
S. S. Kresge	711	691	145,785,473	324,173,813
W. T. Grant Co.	404	495	75,679,203	281,708,699
G. C. Murphy Co.	172	295	19,238,362	184,065,449
S. H. Kress & Co.	221	260	69,041,926	176,241,576
J. J. Newberry Co.	379	478	31,146,802	166,264,827
McCormick Stores Corp.	244	211	43,295,613	107,027,898
McLellan Stores Co.	278	233	21,945,688	63,830,513
Neisner Bros. Inc.	78	127	15,958,818	62,492,197
Totals	4,390	4,750	\$704,761,461	\$2,078,405,852

A comparison of the number of stores operated as of Dec. 31, 1952, with the number operated in 1931, reveals that in several instances national variety chains are operating considerably fewer stores today than twenty-odd years ago. But a comparison of their dollar sales shows that nine of these chains multiplied their combined sales from 1931 to 1952 almost three times.

A significant trend is the expansion that has taken place in the size of the stores operated. Even before World War II, there was a decided trend toward larger, so-called super stores, and since the end of the war all variety chains have been working on extensive remodeling and enlargement programs, with the result that the present day variety store is rapidly becoming one of the largest, best-looking stores in the shopping section of the average American city—barring perhaps only a relatively few department stores of the highest caliber.

The years from 1931 to 1952 saw the rapid growth of the regional or sectional variety chain. Companies like Hested Stores, of Nebraska; Elmore Stores, of Alabama; T. G. & Y. Stores, in Oklahoma; and Duckwall, in Kansas, all capitalized on the growing prosperity coming to the smaller towns as a result of decentralization of population. Three other variety chains—the Sprouse-Reitz Co., Inc., the Scott-Burr Stores Corporation, and Rose's 5-10-25¢ Stores, all of which now operate well over a hundred stores—also came of age during this period.

Current Market.—The following table for Dec. 31, 1952, lists sales, stores, and percentage of the total market for the national, regional, and local variety chains, with an estimate for single store operations:

TYPES OF VARIETY CHAINS, THEIR NUMBER AND SALES

Type of Operation	Chains	Stores	Sales	Per cent of total
Major United States variety chains, operating 100 or more stores (includes 314 Canadian stores)	13	5,522	\$2,266,979,303	72.2
Regional variety chains, operating 10 to 99 stores (includes 258 Canadian stores)	78	2,117	244,839,000	7.9
Local variety chains, operating 3 to 9 stores (includes 63 Canadian stores)	466	1,965	160,369,500	5.2
Two-store variety chains (includes 6 Canadian stores)	605	1,210	73,944,300	2.4
Single variety stores (includes 34 Canadian stores)	...	13,466	386,178,000	12.3
Total United States and Canada	162	24,280	\$3,132,310,103	100.0

A study of the above sales volumes and a comparison with 1931 sales must take into consideration the price inflations of World War II. In fact, the price inflations of World Wars I and II hit particularly hard at the traditional fixed five-and-ten cent price levels of variety chains. Although these stores continued to hold the line

on sizable quantities of nickel and dime merchandise, inflation forced many items into 15, 20, and 25 cent price brackets.

Increased Merchandise Assortments.—The heavy program of remodeling and enlarging existing stores is part of a carefully planned program of increasing merchandise assortments. To satisfy customer demands and to offset rising "cost-to-sell," variety chains have added not only many new lines of merchandise but also better quality and higher-priced lines to their former single popular-priced ones. In addition, to reduce expenses, most variety chains today are experimenting with variations of the grocery supermarket type of check out self-service. Most of these experiments have been confined to relatively low-volume stores.

Increased merchandise assortments and the dollar volume that each department produces are indicated in the table on the next page; the 1952 sales of the 24,280 stores given in the table below are listed according to categories of lines offered.

Variety Stores in Canada.—Among the largest operators of Canadian stores are three United States variety companies. The F. W. Woolworth Company, as of Dec. 31, 1952, was operating 165 stores in Canada. The S. S. Kresge Company operated 67 stores north of the border, and the H. L. Green Company controlled the 82 Metropolitan Stores in Canada. There are several hundred additional Canadian stores operated by Canadian companies, including such firms as People's 5, 10, 15¢ to \$100 Stores, Ltd.; United 5 cents to \$1.00 Stores, Ltd.; Stedman Brothers, Ltd.; R. A. Beamish Stores, Ltd.; and Zellers, Ltd. The last-named company is affiliated with the W. T. Grant chain.

Variety Stores in Great Britain.—The F. W. Woolworth Company operates a chain of approximately 780 stores throughout the British Isles, in addition to which there are many other variety stores operated by British interests.

Variety Stores on the European Continent.—The F. W. Woolworth Company was operating

TYPES OF GOODS AND SALES

Merchandise Lines	Sales, 1952
Apparel and accessories	\$ 824,424,019
Dry goods and domestics	240,958,346
Notions and smallwares	219,261,707
Hardware, paints, electrical supplies, appliances, etc.	231,164,486
Home furnishings	229,911,562
Drugs and toiletries	197,335,536
Toys, games, and books	278,149,137
Stationery	251,837,732
Jewelry	59,827,123
Soda fountains, luncheonettes, and restaurants	202,034,002
Confectionery and nuts	186,059,220
All other lines	202,347,233
Total	\$3,132,310,103

approximately 46 variety stores in West Germany as of Dec. 31, 1952. German interests operate variety stores in both the eastern and western sectors.

The variety store idea has also found acceptance in France, Sweden, Belgium, and Czechoslovakia, and five-and-ten's or close approximations of them operate in India, China, and other parts of the Far East. South America, too, has its chains of five-and-ten cent stores, the most outstanding of which are the *Lojas Americanas* in Brazil. The Woolworth Company operates stores in Cuba, and the S. H. Kress Company has several sizable units in Hawaii.

PRESTON J. BEIL,
Editor, "Variety Store Merchandiser."

DRUG CHAINS

History.—A dozen or more drug chains in operation in the mid-1950's can trace their beginnings to parent stores established prior to 1900. Among them (with the year of their founding) are: Schlegel Drug Stores, Davenport, Iowa (1850); Meyer Bros. Co., Fort Wayne, Ind. (1852); T. P. Taylor & Co., Louisville, Ky. (1879); Jacobs Pharmacy Co., Atlanta, Ga. (1879); Dow Drug Co., Cincinnati, Ohio (1882); Read Drug & Chemical Co., Baltimore, Md. (1883); Marshall Drug Co., Cleveland, Ohio (1884); Skillern's Drug Stores, Dallas, Texas (1885); Kinsel Drug Co., Detroit, Mich. (1888); Cunningham Drug Stores, Detroit (1889); Bartell Drug Co., Seattle, Wash. (1890); Owl Drug Co., San Francisco, Calif. (1892); Eckerd Drug Stores, Erie, Pa. (1898); and Standard Drug Stores, Cleveland (1899). But none of these companies had shown any growth as a chain by the turn of the century. Indeed, the total number of chain drug stores in existence at that time probably did not exceed 75.

Between 1900 and 1910 several additional chains were founded, including some which were destined to become leaders in their field. Among them were Hook Drugs, Indianapolis, Ind. (1900); Dockum Drug Stores, Wichita, Kans. (1900); Walgreen Co., Chicago, Ill. (1901); Peoples Drug Stores, Washington, D.C. (1905); Louis K. Liggett Co., New York (1907); Mading's Drug Stores, Houston, Texas (1907); Katz & Besthoff, New Orleans, La. (1908); and Gallaher Drug Co., Dayton, Ohio (1909).

But it was not until after 1920, when the chains began to expand spectacularly in all fields, that the drug chains likewise showed their greatest growth. What happened in the case of two of

today's leading drug chains reflects the general expansion trend between 1920 and 1930 and the tapering off which marked the years which followed. With 19 stores in 1920, the Walgreen Co. grew to 419 by 1930, an increase of 2,100 per cent. By 1938, it was operating 508 stores, but from then on, following the general trend toward bigger but fewer stores, it reduced its total number of stores to the present level of 406. Peoples Drug Stores similarly grew from 8 stores in 1920 to 117 in 1930, an increase of 1,360 per cent, and although this company now operates 151 stores, its growth since 1930 has been at a much slower rate.

Mid-Century Status.—The United States had in the early 1950's approximately 54,000 drug stores, with aggregate sales close to \$4,500,000,000 annually. Of these stores, some 7,700, or 14 per cent, were chain stores—that is to say, they were owned and operated by companies which had at least two stores, as contrasted with the remaining 46,000 drug stores each of which was operated by a single-store proprietor. Of the total sales, the chains accounted for some \$1,300,000,000, or 29 per cent, annually.

This overall statistical picture tends to obscure the fact that in many of the larger cities of the United States, chain drug stores enjoy the bulk of the available business, since chain drug stores are concentrated largely in urban areas. Not only do they operate relatively more units in the larger cities than they do nationally, but the stores are bigger and have a much larger average volume than the average drug store. The current trend towards shopping centers finds the drug chains operating the drug stores in most of them.

Merchandising Characteristics.—Like most other kinds of chains, the drug chains operate largely on a cash and carry basis, although their units in suburban areas may make deliveries and extend credit in some instances. Because they escape the cost of credit and delivery and enjoy the other advantages which flow from operating a number of stores instead of just one, the drug chains originally found it both feasible and desirable to emphasize their lower prices. Featuring many standard products below the regular price, the drug chains gained recognition as outstanding exponents of cut-price or "loss-leader" merchandising, even though they were by no means the originators of that promotional device nor the only merchants to use it.

However, with the decline in consumer buying-power resulting from the depression in the early 1930's, the drug chains found cut-price merchandising far less attractive than it had previously seemed. The situation was aggravated by the appearance of a new type of proprietary stores, referred to in the trade as "pineboards." These newcomers featured nationally advertised products at deep-cut prices which the chains were in no position to meet.

It was then that the drug chains joined their independent competitors in condemning ruthless price-cutting and favoring legislation to end it. Ever since that period, the drug chains have been ardent advocates of the fair trade laws which currently prevail in 44 states. These laws permit manufacturers of branded products to establish minimum retail prices which are binding on all retailers who deal in them whether they have agreed to abide by such prices or not. Although the fair trade laws have eliminated the use of standard products as "loss leaders" in the drug field, the drug chains have maintained their posi-

tion as aggressive merchandisers in other categories.

Chain drug stores are not only bigger than their predecessors but handle a much broader range of non-drug lines. Despite this trend, however, they have not overlooked the importance of the exclusive franchise they enjoy as registered pharmacies. Their prescription departments are conspicuously placed and pharmaceuticals are actively merchandised. The soda fountain and luncheonette, in which drug stores pioneered, continues as an important feature of modern drug chain operation. See also DRUG TRADE.

GODFREY M. LEBHAR,
Editor-in-Chief, "Chain Store Age."

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CHAINS AND CHAIN MAKING. A

chain consists of a series of similar links which either interlock or are joined to each other so that they form a continuous flexible metal line. The chain is one of the most familiar as well as one of the most useful of mechanical devices. Its origin is undoubtedly very ancient; remnants of excellent Roman chains may be found in the museums of the world. The uses of chain are many, but the three principal uses are for the hoisting of materials, for the transmission of power, and for the conveying of materials. Chains are also used as surveyors' measures, as ornaments, as restraints, as elevator counterweights, and in many other ways too numerous to mention.

All chains may be divided into two general classes which receive their names from the fundamental forms of the links. Coil chains consist of series of links, generally oval in shape, which interlock by passing through one another. Block chains consist, fundamentally, of flat bars which are joined together by cylindrical pins so that the bars are free to articulate about the pins. Coil chains are sometimes loosely called crane chains from the fact that they are generally used in connection with cranes. Block chains are sometimes called link chains, pitch chains, and sprocket chains. Coil chains may be subdivided into open link chains, studded link chains, twisted link chains, safety chains, ladder chains, and jack chains, while block chains may be subdivided into simple block chains, multiple block (leaf) chains, silent chains, detachable chains, and pintle chains.

Open link chains are composed of series of interlocking oval links. The links of such chains are generally made from round bars, the size of the chain being taken as the diameter of the bar from which the links are made. The most common example of an open link chain is the ordinary crane hoisting chain. The links of studded link chains are similar to those of open link chain, being provided, in addition, with studs or braces across the centers of the links. These studs strengthen the links, enabling such chains to carry safely loads 20 to 25 per cent in excess of those which may be safely carried by open link chains of

the same dimensions. Twisted link chains are made up of links similar to those of open link chains which have been twisted through an angle of 90 degrees. Safety, ladder, and jack chains are of minor importance. The first is made up of small flat links which are stamped from sheet metal; the latter two consist of twisted interlocking wire links.

Simple block chains consist of single series of flat bars, each having round holes near its ends, which are joined together by means of pins, rivets or bolts which pass through these holes. The ordinary bicycle chain is, perhaps, the most common example of such a chain. Multiple block chains or leaf chains consist of series of flat bars, similar to those which compose simple block chains, which are placed side by side upon the same pins. A chain of this type has the general appearance of a number of bicycle chains joined side by side. Silent chains are of the multiple block type, being made up of series of flat bars which have profiles on one side much like gear teeth in appearance. Chains of this type operate over sprocket wheels which look very much like spur gears. Roller chains are essentially block chains in which the flat bars have been separated to allow the introduction of a roller between them. Detachable chains are composed of rectangular links which interlock by sliding over one another. This interlocking of the links eliminates the necessity of using pins for joining them. Pintle chains are made up of U-shaped links which have barrels at one end and which are joined by means of pins in the form of either rivets or bolts. Chains are generally made of wrought iron, steel, or malleable iron. When they are subject to excessive corrosion, brass, bronze, or some other corrosion-resisting material may be used.

Chains used as ornaments are generally made of brass, bronze, or the precious metals. Chains used as ships' cables and for hoisting are almost exclusively made of wrought iron, for the ductility and toughness of wrought iron, together with its excellent welding properties, make its use desirable despite its comparatively low tensile strength. The iron used is a specially rolled grade, of high tensile strength and great ductility, the object being to secure a chain which, on the application of a sudden stress—as, for instance, when a ship is riding at anchor in a heavy seaway—will stretch and so resist the strain gradually, instead of snapping, as would be liable to happen with material of higher tensile strength but small ductility or power of elongation. The small sizes of coil chain are sometimes made of steel but, in general, such chains are inferior to those made of wrought iron. Simple block chains, multiple block chains, and silent chains are usually made of mild steel provided, generally, with hardened steel bushings and pins. One or two types of silent chains are equipped with rocker joints which obviate the necessity of using bushings. Roller chains are made of steel and of malleable iron. Roller chains made of steel are similar in construction to block chains. Those made of malleable iron are generally provided with cast iron rollers. Detachable and pintle chains are made, almost exclusively, of malleable iron because of the peculiar form of the links which makes it economical to cast them, although of late many of the smaller sizes of detachable chain have been made from steel on automatic punching presses. The links of pintle chains are sometimes provided with case hardened renewable bushings.

The pins for joining the links of pintle chains are usually steel.

Coil chains of the open, studded, or twisted link type are usually handmade. Many of the smaller sizes—up to $\frac{3}{8}$ -inch—are made on automatic machines, while chains above two inches are made with the aid of power presses and steam hammers. Whether made by hand, by automatic machinery, or with the aid of power presses and steam hammers, the same operations are involved. The bar from which the links are to be made is first cut up into pieces long enough to make single links; the ends of each of these pieces are next scarfed and bent so that when the link is formed the scarfed ends will come together; the scarfed piece is next formed into the shape of the finished link; the formed links are then drawn through the last link of the finished chain and its ends are welded. In making studded or twisted link chain, the additional operation of placing the stud or twisting the link is necessary. These operations are generally performed after the link has been welded. The weld is usually located at the end of the link.

In the smaller sizes the whole operation of chain-making by hand is done by a single smith without any helper. The length of completed chain is hung upon a hook or some convenient support near the anvil, and the operation of forging the link proceeds as follows: In his fire the smith will have two or three short rods of the required diameter, and as one is heated to, say, a cherry red, he withdraws it, cuts off the desired length for one link, gives it a couple of blows to form the welding scarf, bends it through, say, about 130 degrees, hooks it into the end of the completed chain, and brings the ends together for welding. He then raises the link to a welding heat in his fire, places the abutting ends over what is known as the bick-iron, gives it a few taps to ensure a good weld, brings over a "dolly" (which is hinged at the outer end of his anvil and when brought over registers above the bick-iron), and with half a dozen blows on the dolly, accompanied by a dexterous movement of the link, the weld is completed and the link smoothed up to a neat finish. The rapidity with which the smiths do this work is very remarkable. Thus, in the case of a $\frac{7}{8}$ -inch chain, with 30 links to the yard, an expert smith will cut off from the iron bar, scarf, bend up into shape, and weld the links, at the rate of 18 yards in a day or approximately one link per minute.

In forging heavy chain two helpers are used, the iron is cut to about one-foot lengths, and several of these are heated in the fire at the same time. The operation is as follows, the various steps succeeding each other with great rapidity: First, the helper to the right of the anvil withdraws the heated piece, drops one end into an eye at the end of the anvil, and bearing down upon the tongs, bends the piece over to an angle of about 45 degrees. The smith then takes it in his tongs, and with a few taps of the sledge it is bent around. It is heated again, passed through the end of the chain by the smith, and laid flat on the anvil, and the welding scarfs are put on with a few blows of the sledge. The link is now raised to a welding heat, welded with a few blows by the helpers, and laid over the bick-iron; the hinged dolly is brought over, and a few rapid blows on the dolly, while the smith turns the link to and fro, serve to bring the weld up to a smooth

finish. The link is now laid on edge; a single blow from the sledge brings it into shape, and with a final tap or two of the smith's hammer the link is finished. At this forge as many as 35 links will be added to a $1\frac{1}{4}$ -inch chain in one hour, or about one every two minutes.

One type of machine making coil chains winds the bar from which the chain is made upon a mandrel in the form of a spiral much similar to a spring. Each loop of the spiral is then cut apart at an angle of 60 degrees so as to form a scarf, and is welded in a set of dies under a drop hammer operated by a workman. Another type of machinery automatically performs all of the operations, including the welding, taking in a plain round bar and turning out a finished, assembly chain. Weldless chains up to one inch have been made with some success by passing a red hot cruciform bar through a series of machines. The first operation consists of impressing the outer form of the links on the bar. The second operation cuts away the webs which join the links, and the third breaks the links apart and finishes the chain. Coil chain larger than 2-inch can be made entirely by hand only at a tremendous expense of severe labor and time and it is virtually impracticable to attempt to make such chains without the use of power presses for forming the links and steam hammers for welding them. Chains smaller than 2-inch which are made by hand are generally superior to those made by machinery, while beyond 2-inch machine-made chains, after proper annealing, are by far both stronger and more uniform.

Ladder, jack, and similar weldless chains are made by machines which automatically cut off the wire, form the links, interlock them and twist or bend the ends of the links together. Chains of this type can only be made in small sizes and can be used for only unimportant work such as for horse halters, fences, dog chains and the transmission of hand power. Chains made of precious metal are generally made by machinery in a manner analogous to that used in making iron coil chains, except that the links are either left open or are closed by brazing instead of welding. Very often the links of such chains are stamped and brazed by hand. The operations involved in the manufacture of block chains are few and simple. The bars from which simple and multiple block chains, silent chains, and steel roller chains are made are stamped from metal bars of the required width and thickness, the holes for the pins being generally punched while the links are being stamped. In the case of extremely accurate chains, the holes are drilled and the links are finished and polished. The pins of chains of this type are either drop forged, cold rolled, or machine turned. The rollers of roller chains intended for light duty are made of pipe or tubing cut to proper length. For severe duty it is necessary to use rollers which are made by boring out solid shafting. Chains of these types are assembled by hand, usually with the assistance of a small power hammer for forming the rivet heads.

The links of malleable iron detachable and pintle chains are cast and annealed in the usual manner. After annealing, the links are thoroughly cleaned by tumbling and are then assembled to form the finished chain. Some of the smaller sizes of detachable chain are assembled by machines, all of the larger sizes being assembled by hand. All pintle chains are hand assembled with

the aid, when the chain pins are riveted, of small power hammers for upsetting the heads of the rivets. All chains which are to be used for important work are tested after manufacture in order to eliminate the defective links. This is done by subjecting them to test loads well above those under which they are to work and cutting out all links which exhibit defects. Chains which operate over sprocket wheels are also tested for accuracy of pitch and are well oiled and well limbered up before being shipped.

Chains used to hoist materials are generally of the coil type—open link chains being most commonly used. In unusual cases and under peculiar conditions block chains have been used for this work. Chains used for ship's cables are of either the open link or the studded link type. Chains for this duty have been made from bars as large as four inches in diameter. Chains for the transmission of power are generally of the simple block, multiple block, roller, silent, or pintle types. For low speeds, simple and multiple block and pintle chains are most satisfactory; for medium speeds, roller chains are used; for high speeds, silent chains are usually employed. Small sized coil chains are frequently used for the transmission of hand power. Chains for the conveying of materials are generally of the simple block, roller, detachable, or pintle type, although long pitch, open link coil chains were formerly quite extensively used for this work. Chains which convey materials are generally equipped with attachments which serve to carry buckets, flights, aprons, etc., which actually do the conveying. Block chains for the conveying of materials are made with pins up to three inches in diameter and in pitches up to three feet.

Surveyor's chains are open link chains of peculiar construction. The links are relatively long and the ends, instead of being welded, are joined by means of small circular links. A "chain" consists of 100 links, which aggregate 100 feet in the United States and 66 feet in England.

Although each coil chain link consists of two thicknesses of bar, it must not be presumed that a chain possesses double the strength of a single bar; actually there is a reduction of three-tenths in the strength, due to the formation into links, so that the chain has but about seven-tenths of the united strength of two bars of the same diameter of iron. Moreover, as the strength per square inch of a heavy bar is not so great as that of a smaller diameter iron, a further reduction is to be made on this account.

The chain industry is not confined to any one particular country or any one locality. The complete absence of statistics makes it impossible even to approximate its extent.

Technical data on chains may be found in various standard works on machine design and engineering.

CHAIR, an article of furniture consisting of a seat supported by legs, a back, and sometimes arms. One of the oldest furniture forms, the chair for centuries connoted authority or importance, ordinary people being seated on stools or benches. Even today we use "the chair" in parliamentary procedure and "chairman" for one who presides, and speak of a college or university professorship as a "chair."

The oldest chairs extant are Egyptian. Found in tombs, they are of wood, metal, or carved

ivory, and of two types, four-legged and X-shaped. In the former, the legs are carved, ending in animal feet; the seats are solid, or of latticed strapping or woven rush; and the backs are paneled, and attached to solid arms, carved and gilded. The X-shaped ones were originally covered with whole skins. Both types have also been excavated at Nineveh. Chairs of ancient Greece have not survived, and are known only from Greek sculptures and literature; the *thronos* was the chair of authority. Surviving examples show that the Romans had elaborately-made chairs of wood, metal, or ivory, provided with silk-covered cushions. Their X-shaped curule chair was the official seat of magistrates and others in authority. Their *cathedra*, a chair with a back, was used by women.

The scant furniture of the early Middle Ages included no chairs except those of Byzantine provenance. The Chair of Saint Peter (q.v.) at the Vatican is 6th century Byzantine. It is wood overlaid with ivory, and its carving depicts the labors of Hercules. Later, a ruler usually possessed an architectural, paneled chair placed on a dais, with surmounting canopy. Use of chairs in Renaissance Italy was more general. The Roman curule inspired the Savonarola type, but the typical Italian armchair had four legs, a frame ornamented with carving, and an upholstered seat and back. The France of Francis I (r. 1515-1547) copied these but made them more comfortable. During the Louis XIV (r. 1643-1715) period, craftsmen evolved the *fauteuil* and *berçère*, which became graceful and delicate in the Louis XV (r. 1715-1774) period. Springs came into use and fabrics replaced leather.

In England, French designs were followed but considerably adapted. Basic Gothic structure persisted until the Restoration, when cabriole legs became dominant, and lasted through the Chippendale period. After 1770, the classic revival, introduced by the brothers Adam, prevailed. Chair legs were slender, square, and tapering. They became turned and reeded in the Regency years, and other lines were less angular. During the early years of the Victorian age, chairs reverted to continuously curved lines. The Eastlake Gothic resulted in such designs as the Morris chair with adjustable back and thick cushions. American chairs (1650-1850) copied and adapted English designs. With the Windsor and banister back, craftsmen materially enhanced the beauty of line and decorative detail. The rocking chair, sole American original contribution, is credited to Benjamin Franklin and resulted in the Boston Rocker. Outstanding among American chairs are those by Duncan Phyfe (q.v.) and John Henry Belter. Modern furniture design, with its stress on simplicity of line and functionalism, has resulted in chairs of molded plywood and bent metal tubing designed primarily for comfort. See also FURNITURE.

THOMAS H. ORMSBEE.

CHAIR OF SAINT PETER, The, a chair known as *Cathedra Petri*, preserved at the Vatican in Rome. Although its origin is obscure, it is believed by Roman Catholic authorities to have been used by St. Peter in the Santa Prisca Church outside Rome, and removed to Rome by Pope Damascus I in the 4th century. An ancient wooden chair, it was ornamented with ivory and gold, and enclosed in bronze by Pope Alexander VII (1655-1677), who had it placed above the altar in St. Peter's Cathedral. There it remained

for 200 years, but in 1867 it was exposed for the veneration of the faithful by Pope Pius IX. It was then revealed to be a carrying-chair such as was used in ancient Rome. The feast of *Cathedra Petri* is celebrated in the Vatican on February 22.

The name Chair of St. Peter or *Cathedra Petri* is also used to denote the See of Rome or the office of the papacy, from the tradition that St. Peter was the first bishop of Rome.

CHAIREDDIN or **KHAIR-ED-DIN**. See **BARBAROSSA**—**BARBAROSSA II**.

CHAISE, shāz; (1) a two-wheeled carriage for two persons, with a calash top, usually drawn by one horse; (2) any light carriage such as a post chaise; (3) a French gold coin or *chaise d'or* issued by Louis IX in the 13th century. It took its name from the representation of the seated king on the face of the coin. Chaises were also coined in England in the reign of Edward III.

CHAITANYA or **CAITANYA**, chī-tūn'yā, early 16th century Hindu mystic. See also **INDIA**—*Religion and Philosophy*.

CHAKA, chá'ká, a powerful Zulu ruler and conqueror (1773–1828). See also **DINGAAN**; **ZULU LAND**.

CHAKRI, chāk'krē, Siamese (Thailand) dynasty. See also **THAILAND**—*P'ya Takh Sin and The First Chakri Rulers*.

CHALCANTHITE, kál-kán'thīt, native hydrated sulphate of copper, $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$; also called blue vitriol or bluestone. It occurs in triclinic crystals, and in stalactitic or reniform masses; sometimes fibrous or granular. It is dark blue, translucent, vitreous, brittle, and readily soluble in water, and has a disagreeable metallic taste. The hardness is 2.5 and the specific gravity ranges between 2.12 and 2.30. It is found in Chile; Cornwall, England; Spain; and in many copper-mining localities in the United States, where it is frequently deposited from mine waters.

CHALCEDON, kál'sé-dón, or **CHALCHEDON**, kál'kě-dón, an ancient city (modern KADIKÖY, q.v., in Turkey) of Bithynia, Asia Minor, on the Bosphorus opposite Byzantium (now Istanbul) and at the entrance of the Euxine Sea or Black Sea, located about two miles south of Scutari (now Uskudar). Chalcedon is said to have been founded 17 years before Byzantium, about 677 B.C., by Greek colonists from Megara. Less favorably situated than the latter city, it was also called in antiquity "City of the Blind." Nevertheless, it flourished in trade, and finally joined the Athenian League when the Greek cities freed themselves from Persian rule in 389 B.C. Chalcedon was an important township when it was bequeathed to the Romans, along with the rest of Bithynia, by Nicomedes III in 74 B.C. By giving it to Rome, Nicomedes had hoped to keep it safe from Mithridates, but the latter followed the Romans to Chalcedon, destroyed the fortifications of the port, and burned or captured their ships. About 616 A.D. it was captured by Khosrau (Chosroës) II of Persia, and in 1075 it was destroyed by the Turks. Its site is now occupied by the city of Kadiköy, virtually a suburb of Istanbul.

At Chalcedon in 451 A.D. (October 8 to Novem-

ber 1), the emperor of the East, Marcian, summoned the fourth general (oecumenical) council of the church—known in ecclesiastical history as Council of Chalcedon—for the purpose of eradicating the Monophysite doctrines which had prevailed under the influence of Dioscurus, the patriarch of Alexandria, and of Eutyches (q.v.) since the so-called Robber Synod (Council) at Ephesus in 449. The aim of the Council of Chalcedon, therefore, was to define the Christian faith so as to guard its orthodoxy against the Nestorian and Monophysite heresies. The council opened under the guidance of Paschasinus, the bishop of Lilybaeum (Marsala), acting as deputy of Pope Leo I. About 600 bishops, mostly from the East, were present. The bishops of the West were largely prevented from coming because of the activities of Attila the Hun.

The sessions were held outside the city, in the Church of St. Euphemia, which was later destroyed by Suleiman, who built a mosque in its place. The council deposed Dioscurus; and after a violent debate settled upon the articles of faith, declaring, in opposition to the Monophysites, the doctrine of the two natures of Christ, existing without mixture or change, without division or separation, so that by the union of the two natures in one person and substance their distinction is not destroyed, but the characteristics of each are retained. The controversy, however, continued. Besides this creed, the council promulgated 30 canons against clerical abuses, of which the 28th conceded to the See of Constantinople (Byzantium) rights and privileges second only to the Roman See; but Pope Leo I refused to confirm this decree.

Rebellions in Palestine, Egypt, and other Near Eastern countries (where Monophysites still survive today) were the immediate consequences of these decrees of the council, and not until after a long period of ecclesiastical controversy did the Chalcedon formula obtain the undisputed authority which it now has in the Roman Catholic, Greek Orthodox, and in many Protestant churches. See also **EUTYCHIANISM**.

CHALCEDONY or **CALCEDONY**, kál-séd'ō-nī, a silica mineral named for Chalcedon, an ancient Greek town of Asia Minor. It is a cryptocrystalline variety of quartz, semitransparent to translucent, with a waxy luster, and white, gray, blue, brown, or black in color, but commonly of a tint suggestive of diluted milk, marked with veins, spots, or circles. It occurs in masses, also very frequently in mammillary, botryoid, and stalactitic forms. It is used for ornament, and is often called "white agate." There are several varieties, such as common chalcedony, chrysoprase, prase, carnelian, onyx, agate, jasper, flint, sard, sardonix, plasma, heliotrope (blood stone), and moss agate (mocha stone). The crystals of chalcedony are so minute that their structure is visible only through a microscope.

CHALCEDONYX, kál-séd'ō-nīks, semiprecious stone. The name applies to those agates in which opaque white chalcedony alternates with the translucent gray variety.

CHALCHIHUITL, chāl-chī-wē't'l, or **CHALCHUITE**, chāl'chōō-it, a blue or green mineral, highly valued by the Aztecs of Mexico, who worked it into gems. It was extracted in what is today New Mexico.

CHALCHUAPA, chäl-chwä'pä, city, Salvador, in Santa Ana Department, about 8 miles west of Santa Ana, with which it is linked by rail and highway. It is a coffee center, also noted for the pre-Columbian ruins in its vicinity. Chalchuapa was the site of a battle (1885) in which the president of Guatemala, Justo Rufino Barrios, fell. Pop. (1950) 9,855.

CHALCID FLIES, a group of parasitic Hymenoptera included in the superfamily Chalcidoidea, most of which are beneficial because they attack other insects which are injurious to plant life, although a number attack plants. A good many are looked upon as pests because they are parasitic upon their own parasitic relatives and other beneficial parasites. The vast majority are extremely small and the group includes *Alapetus magnanimus*, about $\frac{1}{400}$ of an inch long, which is believed to be the smallest insect. The largest member of the group is the American *Pelecinus polyturator*, a blue black species, with long thread-like abdomen, the female of which attains a length of more than two inches. The larvae are parasitic on white grubs of the Coleopterous family Scarabaeidae. The superfamily is divided into 18 families, which exhibit a great divergence of habits. They may be phytophagous, and some are gallmakers or parasitic upon gallmakers. In many of the families there are species which are parasitic upon the eggs of other insects: the females are able to puncture the shell of the egg and deposit an egg within, without injury to the attacked egg. One of the best known of these is *Tetrastichus asparagi*, the larvae of which develop in the eggs of asparagus beetles. *T. bruchophagi* is a parasite of the clover seed chalcid. In addition to attacking eggs, the larvae also develop in the larvae, pupae, and adults of Lepidoptera, beetles, bugs, and other insects. Several species, such as *Prestinidica aquatica*, swim under water to locate the eggs of damselflies, beetles, and bugs. On the whole, the group is beneficial.

CHALCIDICE, käl-sid'i-sē (Greek KHALKIDIKE, käl-kyē-thē-kyē'), peninsula, eastern Macedonia, Greece, projecting into the Aegean Sea in three promontories, now called Pallene or Kassandra, Sithonia, and Akte—the latter the site of Mt. Athos. In the 6th and 7th centuries B.C., two tribes, Chalcidians and Bottiaei, with settlers from Greece proper, colonized the peninsula. Olynthus and Potidaea were the chief towns on the isthmus of Pallene (Kassandra); Scione and Mende were on the southwest of Pallene; Torone on the southwest part of Sithonia. The colonists supplied timber and wines to Greece.

After the Persian Wars, in 479 B.C., Chalcidice joined the confederation of Delos, but in 424 B.C. Olynthus and several other towns were freed from Athens by Brasidas, and others became independent in 404. The Chalcidian cities under the leadership of Olynthus and Potidaea formed a league, disbanded after a siege by the Spartans (379 B.C.), and again reformed. They joined the Second Athenian League, but withdrew in 371 and fell to Philip II of Macedon (r. 359–336 B.C.), who enslaved and transplanted many of the inhabitants, repopling the peninsula with Macedonian veterans. In the 2d century B.C. it fell to Rome.

In its modern form the peninsula is divided into the departments of Salonika and Chalcidice. The city of Salonika (Thessalonika) is at its northern base.

CHALCIS, käl'sis, or **CHALKIS**, käl'kis (Greek KHALKIS, Käl-kyēs'), capital of the island and department of Euboea, located at the junction of the Atalante and Ey(u)ripos channels. The latter is narrowed to 85 feet at Chalcis by a rock, surmounted by a castle, partly of Venetian, partly of Turkish origin. The main channel, 120 feet wide, was once crossed by a drawbridge which has been removed in clearing and widening the channel for larger vessels. The city is one of the most attractive in Greece, consisting of an inner walled town and an outer or suburban portion, the walls being the work of the Venetians. In the inner town the streets are narrow and the houses lofty. Several of the churches were formerly mosques. The modern town is a rail terminus and trading center for wines, cereals, livestock, olives, figs, and citrus.

Ancient Chalcis was one of the greatest Ionian cities. It carried on a large trade, and planted numerous colonies in Macedonia, Italy, Sicily, and the islands of the Aegean Sea. The Chalcians joined the Boeotians (Thebans) in a war with Athens, in which they were defeated (506 B.C.). A series of revolts against Athens ended in 411 B.C. in a short period of independence. The city was subsequently occupied by the Macedonians, and eventually fell under the yoke of Rome, which made it a place of great military importance. In Roman times it was nearly nine miles in circumference, and contained temples, theaters, and other public buildings. Chalcis was the birthplace of the orator Isaeus and the poet Lycophron; and Aristotle died here. The city was partly destroyed when the citizens joined the Achaeans in their last war with Rome (146 B.C.). It was afterward rebuilt, and at the beginning of the Christian era was the chief city of Euboea, temporarily known as EVRIPOS. The Venetians, who called it NEGROPONT (Negroponte), held it from 1209 A.D. to 1470, when it was taken by the Turks. In 1833 it became part of the kingdom of Greece. The Germans occupied the city in World War II (1941). Pop. (1951) 26,097.

CHALCIS FLIES. See **CHALCID FLIES.**

CHALCOCITE, käl'kō-sīt (from Greek *chalkós*, copper), a native sulphide of copper having the formula Cu_2S . It crystallizes in the orthorhombic system, though it usually occurs in massive and sometimes granular forms. Its hardness ranges from 2.5 to 3, and its specific gravity from 5.5 to 5.8. Opaque and leaden in color, it has a metallic luster. In the United States it occurs in crystals at Bristol, Conn.; massive as the principal copper ore at Butte, Mont., and in many copper mines in Arizona and other southwestern states and in Southwest Africa, Spain, Mexico, Chile and Peru. Beautiful crystals come from Cornwall, England. The mineral contains 80 per cent of copper, ranking as a source of copper next in importance to chalcopyrite (q.v.). Chalcocite is known also as copper glance, chalcocin, and redruthite (from the town of Redruth in Cornwall).

CHALCONDYLES, käl-kōn'di-lēs, or **CHALCOCONDYLAS**, käl-kō-kōn'di-lās, Demetrius, Greek scholar: b. Athens about 1424; d. Milan, Italy, 1511. Like his teacher Teodoro Gaza, the Greek scholar, he went to Italy to teach the Greek language and literature. His first patron there was Cardinal Johannes Bessarion, him-

self a Greek. Later, about 1479, he was asked by Lorenzo de' Medici to come to Florence, and in 1492 was invited by Lodovico Sforza to Milan. Chalcondyles played a prominent part in the classical revival in Italy, spreading the study of Greek in western Europe through the many scholars he trained, among them Johann Reuchlin, the German humanist. Besides a Greek grammar entitled *Erotemata* (?1493) he published editions of Homer, Isocrates, and Suidas, which are somewhat arbitrary in the emendations of the text.

His brother LAONICUS CHALCONDYLES (d. 1464), after witnessing the fall of Constantinople, where he was ambassador of the ruler of the Eastern Roman Empire, followed Demetrius to Italy, and wrote a valuable history of the last years of the Byzantine Empire (from 1298 to 1463) in ten volumes.

CHALCOPYRITE, *kāl-kō-p'rit* (from Greek *chalkós*, copper), a native sulphide of copper and iron, also called copper pyrite, having the formula CuFeS_2 or $\text{Cu}_3\text{S} \cdot \text{Fe}_2\text{S}_3$. It crystallizes in the tetragonal system, commonly with a tetrahedral aspect. Chalcopyrite is brasslike in appearance, and is often tarnished and iridescent. It has a specific gravity of 4.1 to 4.3 and a hardness ranging from 3.5 to 4. The mineral is widely distributed in the United States (Montana, Arizona, New Mexico, and Utah) and constitutes the chief copper ore in Cornwall, England. Other deposits are at Sudbury, Canada; Riotinto, Spain; Falun, Sweden; and in Chile. Because of its iridescence it is often called "peacock ore." Chalcopyrite is softer and deeper in color than ordinary iron pyrites, with which it is often confused.

CHALDEA or CHALDAEA, *kāl-dē'ā*, in ancient geography originally only the southerly part of Babylonia (q.v.), toward Arabia and the Persian Gulf, lying along the then separate mouths of the Tigris and Euphrates rivers. In the Bible it came to be synonymous with all of Babylonia. The Chaldeans are supposed to have been at first a nomadic Semitic people hailing from Arabia, but they later became settled and finally secured the throne of Babylonia in 625 B.C. They helped to bring about the fall of the Assyrian Empire in 612 B.C., and in 597 and 586 B.C., under Nebuchadnezzar II, subdued Judaea and captured Jerusalem. Their name was transferred to the Babylonian Empire, but was dropped when the Persians captured Babylon in 539 B.C. The name Chaldean was especially applied by the author of *Daniel*, Herodotus, and other writers of antiquity, to some of the Babylonian magi, who were devoted to the pursuit of astrology and magical science.

CHALDEAN CHRISTIANS. See NESTORIANISM.

CHALDEE MS., The, a skit at the expense of a rival publisher, Archibald Constable, and of the Edinburgh notables associated with the Whig paper, the *Edinburgh Review*, and published in the seventh number of the new Tory publication, *Blackwood's Magazine*, October 1817. It was written in the form of an alleged biblical narrative in four chapters, by James Hogg, the "Ettrick Shepherd," whose original paper was greatly enlarged and modified by John Wilson ("Christopher North") and John Lockhart.

CHALET, *shā-lā'* (French for "little cas-

tle"), the Alpine houses of Switzerland and the adjacent regions of France, Bavaria, and the Austrian Tirol. It is a French-Swiss name, which is applied to modest huts as well as to picturesque villas built of timber in a unique style, chiefly distinguished by a low overhanging roof, elaborate woodwork, and the frequent use of balconies.

CHALEUR BAY, *shā-lōōr'* (Fr. BAIE DE CHALEUR, *bād' shā-lūr'*), an ocean inlet, Canada, in the western part of the Gulf of St. Lawrence, between the Gaspé Peninsula in southeast Quebec Province and New Brunswick. It is a submerged valley of the Restigouche River which flows into it. About 85 miles long from east to west, it has a maximum width of over 20 miles, and a depth of 250 feet. It was discovered by the explorer Jacques Cartier in 1535. The bay has a number of islands, notably Shippegan near its mouth. Navigation is good, and mackerel, cod, and salmon fishing are carried on. In 1760 the French fleet was defeated here by the British.

CHALFONTE SAINT GILES, *chāl'fünd-sünt-jilz'*, village, England, in southeast Buckinghamshire, seven miles east of High Wycombe, within Amersham rural district. Listed in the *Domesday Book* as Celfunte, it is an old town, quite unspoiled, and has on its main street the cottage where John Milton lived during the great plague and where he finished *Paradise Lost*. The cottage is now owned by the National Trust and is open to the public. Not far away is the little village of Jordans, where there is a charming old Quaker meeting place in whose cemetery William Penn is buried. Pop. (1951) 2,882.

CHALGRIN, *shāl-grän'*, Jean François Thérèse, French architect: b. Paris, 1739; d. there, Jan. 20, 1811. A student of Giovanni Niccolò (Jean Nicolas) Servandoni in Paris, he won the Grand Prix de Rome in 1758, and became a member of the academy of architecture in 1770. His Italian studies awakened in him a passion for the simple lines of classical Greek architecture, which are reflected in most of his work. On his return to Paris, Chalgrin built the Palace Lavrillière (now de Rothschild), reconstructed the church of St. Sulpice, and designed the church of St. Philippe-du-Roule. In addition, he executed major alterations on the Collège de France and the Palace de Luxembourg; but he is best known for his plans for the Arc de Triomphe de l'Étoile which was begun under his supervision in 1806, though completed long after his death, during the reign of Louis Philippe.

CHALGROVE, *chāl'grōv*, village, England, located in south Oxfordshire, nine miles southeast of Oxford. It is the site of a famous victory (1643) of the Royalists under Prince Rupert over the Parliamentarians under John Hampden, who was mortally wounded here, though he died at nearby Thame. An obelisk marks the spot where Hampden fell. The village church goes back to the 12th century. Pop. (1951) 388.

CHALIAPIN, *shū-lyā'pyin*, Fyodor Ivanovich (Russ. SHALYAPIN), Russian operatic basso: b. Kazan, Russia, February 1873; d. Paris, France, April 12, 1938. At one time or other, before seriously taking up the study of music, he was a cobbler, pawnbroker's assistant, carpenter, and government clerk. His musical career began as

choirboy in Kazan. Later he joined a traveling light opera company, and was stranded at Tbilisi (Tiflis) where the singer Usatov (Oussatov) offered to train his voice. He made his operatic debut in Tbilisi in Mikhail I. Glinka's *A Life for the Czar* in 1892.

In 1894 he left Tbilisi and sang at various theaters in Moscow and St. Petersburg (now Leningrad). He joined a private opera company in 1896, and appeared in many roles, notably that of Ivan the Terrible in the first production of Nikolai A. Rimski-Korsakov's *The Maid of Pskov* (*Psokovitianka*); in 1898 he achieved one of his greatest successes in *Boris Godunov*, Rimski-Korsakov's revision of Modest P. Musorgski's opera. Chaliapin also sang in Milan (first in 1901), Paris, and Monte Carlo. His soaring international fame owed as much to his acting ability and fine carriage as to his remarkable voice. Among the most celebrated roles of his career were the title roles in Rimski-Korsakov's *Ivan the Terrible*, in Arrigo Boito's *Mefistofele*, and in *Boris Godunov*.

Chaliapin's debut in London came under Sir Thomas Beecham in the Russian opera season of 1913-1914, when he triumphed in *Boris Godunov*, *Prince Igor*, and *La Khorunshchina*. Heading the Mariensky Theater, he remained in Russia during World War I until 1921 when he appeared for a time in London. He had visited the United States to sing at the Metropolitan Opera, New York, in the 1907-1908 season, but was then little noticed; returning in 1922 to replace Enrico Caruso as leading singer, he received undivided acclaim, particularly for Boris in *Boris Godunov* and Mephistopheles in Charles François Gounod's *Faust*. Another of his renowned parts was in Jules Émile Frédéric Massenet's *Don Quichotte*, a work specially written for him.

Though he made occasional appearances in Russia and the European countries, Chaliapin now sang mainly with the Chicago and New York opera companies until his last performance at the Metropolitan on March 20, 1929. In 1927 the Soviet government had deprived him of his title "Artist of the People" and had confiscated his estates, whereupon he left his native country for good. When later he was invited to return and sing, he refused, and became a French citizen, making his home henceforth in Paris. Chaliapin's reputation as the greatest singing actor of his day was now well established, and audience and reviewers marveled at his superb characterizations and magnetic personality. In 1934 he enacted the title role in the French motion picture *Don Quichotte*. His last appearance on the stage was in 1935, though he made a brief concert tour in the Far East in 1936. Two of the songs he popularized were the *Song of the Volga Boatmen* and *The Song of the Flea*. He wrote two autobiographic volumes, *Pages From My Life* (1927) and *Man and Mask* (1932).

CHALICE, chāl'is (from Lat. *calix*, cup), the sacred vessel of the Christian churches in which the consecrated wine is administered at the Eucharist, the ceremony of the Communion. It symbolizes the cup used at the Last Supper and is the emblem of many saints, particularly of St. John the Evangelist.

The early Christians at first used plain glass chalices, but later decorated them with goldleaf. Some authorities say that wood was the first material used. As it advanced from poverty the

church made the vessel of horn, then of ivory, and later of precious metals. Chalices of bone were used in Germany, but this material was forbidden in 787.

Chalices were classified by the clergy as *ministeriumales*, used for distributing the wine to large numbers on holidays like Easter; and *offertorii*, used on ordinary occasions. The former usually had handles (*calices ansati*), as they were quite large and heavy.

The ecclesiastical chalice is made up of three parts: the cup or bowl; the stem with its middle swelled into a bulb or other protuberance (termed a knob) to prevent its slipping when held; and the foot. In very early times, the paten—the vessel which holds the consecrated bread—was likewise termed a chalice.

From altar depictions of the 6th to 9th centuries it may be assumed that the earliest chalices were of the Greek cantharus shape. Next appeared a form similar to that of the present day, but much larger. For example, it is said that Charlemagne (r. 768-814) presented St. Peter's at Rome with a pure gold chalice weighing 53 pounds. After the 12th century chalices became smaller, losing their handles, and the bowls became conical or semiovoid. Wine was distributed from the large chalices through a small pipe (*fistula* or *calamus*) of gold, silver, or ivory,



A modern chalice.

which had one or more handles. Examples of such types are still extant.

Chalices may also be divided into the following classes: pontifical chalices for use on festive occasions; those used at common mass; "traveling" chalices for use when visiting distant places—usually small and frequently in parts that could be separated and packed into a small compass; and funeral chalices, generally of lead or other common metal, for burial with bishops.

Wilfred Joseph Cripps, a noted authority on the subject, groups chalices into the following period types: (1) Norman (about 1170-1350), with circular feet; (2) Gothic (about 1350-1510), with hexagonal feet and conical bowls, and later (1490-1510) feet with toes; (3) Tudor (about 1510-1536), with six-lobed, flowing feet and bowls often less conical or nearly hemispherical.

Octavius Morgan, another expert, tells us that the feet were made out of the round (usually hexagonal) to prevent the chalice from rolling when laid upon its side to drain. Fine enamel and chased work usually appear on the knob, stem, and foot, frequently representing the Passion or other sacred subjects. One side may have a cross, which the officiating priest keeps facing him. The bowl is generally quite plain and highly polished, so as to be easily kept clean.

An example of a very fine early chalice may

be seen at The Cloisters, a branch of the Metropolitan Museum of Art, in Fort Tryon Park, New York City.

CHALICOTHERE, kăl'ī-kō-thēr, a mammal of the extinct family Chalicotheriidae of the Perissodactyla, found fossilized in various parts of the Northern Hemisphere from the Eocene epoch onward. It disappeared toward the close of the Miocene epoch in America and Europe, but persisted in southern Asia and in Africa, at least into the middle of the Pleistocene. Among the better known genera are *Pernatherium*, *Eomoropus*, *Moropus*, *Schizotherium*, *Macrotherium*, *Chalicotherium*, and *Ancylotherium*. They were fairly large forest-dwelling animals, perhaps resembling horses in form, with the teeth of a hoofed animal, but long burrowing claws like those of a rodent. The problem of their habits and mode of life is still unsolved, but it is inferred that they fed chiefly on leaves. Remains of *Moropus* were found at Agate Springs, Nebr.

Consult Scott, William Berryman, *Land Mammals in the Western Hemisphere* (New York 1913); and Romer, A. S., *Vertebrate Paleontology*, new ed. (Chicago 1950).

CHALIER, shāl'yā, (Marie) Joseph, French revolutionist: b. Beaulard, Dauphiné, France, 1747; d. Lyon, 1793. Although educated for the church, he engaged in business instead, and traveled for a Lyon firm in Spain, Portugal, Italy, and the Middle East. At the outbreak of the French Revolution in 1789, he was in Paris, and associated himself with Maximilien Robespierre, Jean Paul Marat, and Camille Desmoulins. Returning to Lyon he became (1791) the first member of the municipal bureau, and led in the civic reorganization that ensued; and his administration was approved in the face of criticism in the Legislative Assembly. In 1792, however, Chaliere was defeated by a Royalist in an election for mayor of Lyon. He became a leader of the local Jacobins, and in 1793 precipitated a conflict which ended in his arrest and sentencing by the tribunal of Rhône-et-Loire. He was guillotined, notwithstanding stay proceedings in the National Convention.

CHALK, chók, in geology a soft, friable, finely granular variety of limestone, composed principally of carbonate of lime (calcite or calcium carbonate), frequently with a small admixture of clay minerals, and in some chalks such as those in southern England, with nodules of silica, flint, or chert. Its color ranges from pure white to grayish and buff.

Chalk is a marine deposit, largely consisting of shells of minute organisms, Foraminifera, as well as other fossils. The name of the Cretaceous, in which chalk occurs, is from the Latin *creta*, chalk, referring to the beds early studied in Europe. Cretaceous chalk forms the cliffs of Dover along the English Channel. Chalk in the Cenomanian, Turonian, and Senonian stages of the geological system extends from Flamborough Head, Yorkshire, on the east coast to Dorset on the south. Similar Upper Cretaceous chalk forms a ring around the Paris Basin in France and appears interruptedly northward to Denmark. The best known chalk formations in North America belong also to the Upper Cretaceous. On the coast of the Gulf of Mexico, a chalk belt extends for hundreds of miles northeast and southwest from Austin, Texas, a few hundred feet thick at

the surface, and continuing beneath the surface toward the Gulf. Similar chalk crops out in Alabama, and in the northern Mexican states of Chihuahua, Coahuila, and Tamaulipas. Chalk of about the same age, generally called Niobrara, is found in Kansas and Nebraska, and westward in Colorado and Wyoming.

Chalk is widely used as one of the principal constituents in the making of cement. It forms an important source of agricultural limestone, and is burned for quicklime. Beds that are more indurated are called limestone, which in many regions is used as building stone. In smaller quantities, and after purification, chalk is used as whitening in cleaning substances (specially for metalware), rubber materials, and putty, and to allay stomach acidity. The common chalk of the schoolroom is a manufactured substance, not generally made from natural chalk. See also CALCITE; CALCIUM; CEMENT; CRETACEOUS; and LIMESTONE.

CHALK RIVER, village, southeast Ontario, Canada, on the Chalk River—flowing nearby into the Ottawa River—95 miles west-northwest of Ottawa. It is the site of a government research station operated by the National Research Council of Canada for Atomic Energy and has an atomic pile of heavy water, established in 1947.

CHALKE, khāl'kē, Greek island of the Dodecanese.

CHALKHILL, chók'hil, John, English poet: fl. ?1600. Known as the author of the pastoral *Thealma and Clearchus*, published in 1683 with an introduction dated five years earlier—by Izaak Walton. Walton also included two of Chalkhill's songs in the *Compleat Angler*. Virtually nothing is known about his life, though he has been tentatively identified with Ivon or Ion Chalkhill, a coroner of Middlesex County. His poetry was reprinted in George Saintsbury's *Minor Caroline Poets*, vol. 2 (London 1906).

CHALKLEY, chók'klē, Thomas, Anglo-American Quaker: b. Southwark, England, May 3, 1675; d. Tortola, Virgin Islands, Nov. 4, 1741. He went to Virginia in 1698, visited the Puritan settlements, and in 1701 bought land in Philadelphia. Besides engaging in profitable trade there, he went on extensive trading and preaching tours that took him to Barbados, various parts of the American colonies, and later to England, Scotland, the Netherlands, and Germany. His interesting experiences were recorded by him in his highly readable *Journal*, which was frequently reprinted in England.

CHALLEMEL-LACOUR, shál-mēl'-lā-kōor', Paul Armand, French statesman and philosopher: b. Avranches, Manche, France, May 19, 1827; d. Paris, Oct. 26, 1896. Having graduated from the École Normale Supérieure in 1894, he became a professor in the schools of Pau and Limoges. When he protested against the coup d'état (1851) of Napoleon III, he was imprisoned and then exiled. Fleeing to Belgium and afterwards to Switzerland, he taught French literature at the Federal Institute of Technology, Zurich (1856-1859). Upon his return to France in 1859 he wrote prolifically for the reviews, and gained the confidence of the republican parties. In 1870 he was appointed prefect of the Rhône

Department; two years later he became a deputy to the National Assembly, and he was elected senator in 1876. From 1879 he was ambassador, successively, to Switzerland, Russia, and England; minister of foreign affairs in 1883; and in 1893 president of the Senate. In the latter year he was elected to the French Academy.

A friend of Léon Gambetta, Challengel-Lacour was noted as one of the foremost orators on the French political scene. He also wrote penetrating philosophical studies, among them *La philosophie individualiste* (1864), a work on Wilhelm von Humboldt, and *Études et réflexions d'un pessimiste* (1901).

CHALLENGER, chă'lin-ür, **Frederick Sproston**, Canadian artist: b. Whetstone, Middlesex, England, July 7, 1869. Although his family moved to Canada when he was a child, he returned to England for his education, then studied art at the Ontario School of Art, Toronto, in 1883-1884 under George Agnew Reid, and completed his training abroad. Challenger became a full academician of the Royal Canadian Academy in 1899, serving for six years on its council. He was awarded medals at the Pan-American Exposition in 1901 at Buffalo and at the Louisiana Purchase Exposition in 1904. From 1921 to 1924 he was an instructor at the Central Technical School at Toronto; and at the British Empire Exhibition at Wembley, England, in 1924-1925, he was a member of the jury of the Canadian art section. Some of his paintings are *Fathers of Confederation* at the Ontario Parliament Buildings, Toronto; *Harvest, A Song at Twilight, Wild Steeds of the Prairie, A Selkirk Pioneer, Aphrodite's Realm*, and *The Evening Breeze*. His mural work appears in hotels, theaters, and public buildings in Canada.

CHALLENGE, in law, an objection or exception, particularly a formal expression of opposition to a juror. Challenges may be made to either grand or petit jurors. Exceptions to the entire panel of jurors are called "challenges to the array," while objections to individual jurors are known as "challenges to the polls." The latter class are divided into "challenges for cause" and "peremptory challenges" for which no cause is required. As a general rule, there is no limit to the number of challenges for cause which are permitted. The number of peremptory challenges is regulated by statute in all civil actions and in most criminal cases.

Either party has the right, in both civil and criminal cases, to have the jurors sworn and examined as to their qualifications. This procedure, called *voir dire* examination, is subject to the discretion of the court. The grounds for a challenge for cause, usually specified by statute, are either lack of general qualifications for jury duty, or the existence of particular factors making the juror unfit to serve in the case on trial. Typical grounds are bias or prejudice, pecuniary interest in the litigation, prior formation or expression of an opinion on the case, and relationship to one of the parties.

The right to question jurors on the *voir dire* is generally held to include the eliciting of facts on which to base a peremptory challenge, as well as to demonstrate grounds for a challenge for cause. The right of peremptory challenge in civil cases did not exist at common law, but has been expressly conferred by statute in most jurisdictions.

In criminal cases, the defendant's right of peremptory challenge was narrowly limited at common law to trials for felonies, or for crimes subject to capital punishment. The prosecution had no right of peremptory challenge at common law, except in very early times, when the crown's right of peremptory challenge was unlimited. Most jurisdictions have expressly provided by statute for peremptory challenges in criminal cases by both the accused and the prosecution thereof.

In both civil and criminal cases, the number of peremptory challenges varies in different jurisdictions. In criminal cases, the number is ordinarily regulated according to the nature of the offense and the severity of the punishment which may be imposed for it. In federal criminal cases, for example, the number of challenges varies according to the extent of the punishment to which conviction of the offense charged may subject the accused, the maximum number being twenty challenges to each side, when the offense is punishable by death. If there are two or more defendants, the court may allow the defendants additional peremptory challenges, permitting them to be exercised either separately or jointly. In federal civil cases, each party is entitled to three peremptory challenges, a group of plaintiffs or defendants being generally treated as a single party for such purpose. The right to challenge members of courts martial and military courts of inquiry is governed in the United States by the provisions of the Uniform Code of Military Justice, enacted in 1950.

RICHARD L. HIRSHBERG.

CHALLENGER EXPEDITION, a long cruise conducted from Dec. 7, 1872 to May 24, 1876 under the auspices of the British government for the purpose of exploring the open ocean. H.M.S. *Challenger*, a corvette of 2,306 tons, was fitted with a great variety of appliances for scientific research, and placed in command of Captain George Strong Nares. Professor C. Wyville Thomson headed a scientific staff of six naturalists, among them John Murray and Henry Nottidge Moseley, who conducted investigations to determine the depth of waters, the configuration and conditions of the sea floor, the marine fauna, the temperatures and compositions of sea water, the ocean currents, atmospheric conditions, and other data.

After leaving Sheerness, Kent, England, the expedition spent a year in the Atlantic, and in October 1873 reached Capetown, South Africa, going on then to Australia, Japan, and Hawaii, then to the west coast of South America, and through the Strait of Magellan back to England, disembarking at Spithead near Portsmouth. The *Challenger* was the first steamship to cross the Antarctic Circle. On their return to England, Nares, Thomson, and Murray were all knighted. They had traveled 68,890 nautical miles and made soundings at 362 stations. The material they collected took many years to study. Thomson died in 1882, and Sir John Murray completed the report, which was gradually published in 50 volumes (London 1880-1895). The narrative of the expedition is told in more popular form in Dr. Henry Nottidge Moseley's *Notes by a Naturalist on the Challenger*, 2d ed. (London 1892), a work that for its scientific importance and literary charm has been compared to Charles Darwin's *Journal of the Cruise of the Beagle*.

CHALLIS, chāl'is, James, English astronomer: b. Braintree, Essex, England, Dec. 12, 1803; d. Cambridge, Dec. 3, 1882. Educated at Trinity College, Cambridge, he became a scholar there in 1824 and was elected Plumian professor of astronomy and experimental philosophy in 1836, assuming also the direction of the observatory. In 1861 he gave up the latter position, but retained the professorship of astronomy until his death. He is probably best known for his work on astronomical instruments, and for his observations in connection with the discovery of the planet Neptune, based on Urbain Jean Joseph Leverrier's investigations of the disturbed motions of Uranus. The discovery of Neptune was, however, announced (1846) in Berlin, before Challis was able to draw the final conclusions from his own research, which had actually noted the position of Neptune a few weeks earlier.

Equally significant for Challis' stature as a scientist was his ambition to account for all physical phenomena in a unified mathematical theory of science. His inventions include the collimating eyepiece, a transit reducer, and a meteoroscope. He contributed some 225 essays to publications, and wrote in addition several books on astronomy, mathematics, and physics.

CHALLONER, chāl'ō-nēr, Richard, English Roman Catholic prelate: b. Lewes, England, Sept. 29, 1691; d. London, Jan. 12, 1781. Though his father was a Protestant dissenter, he was brought up in the Catholic Church to which his mother belonged. At the age of 13 he entered the English college at Douai in France, and after completing his studies, was made professor of rhetoric and philosophy there (1713), ordained (1716) priest, and later appointed vice president of the college (1720) and professor of divinity. He remained at Douai until 1730, when he was sent to London to preach and make converts. An anti-Catholic treatise by Dr. Conyers Middleton drew him into a heated controversy and he had to withdraw from England for a few months.

In 1740 he was consecrated bishop of Debra and coadjutor to the vicar apostolic of London, and he succeeded to the vicariate in 1758. Among Challoner's varied writings are the devotional *The Garden of the Soul* (probably 1740), still in general use among Roman Catholics as a prayer book. He wrote also *Memoirs of Missionary Priests . . . from the Year 1577 to 1684*, 2 vols. (1741-1742). His revision of the Douai-Reims English version of the Old and New Testament appeared under the title *The Rheims New Testament and the Douay Bible, with annotations*, 5 vols. (London 1749-1750). His translation of Thomas a Kempis's *Imitation of Christ* was widely circulated.

Consult Trappes-Lomax, M., *Bishop Challoner, derived from Dr. Edwin Burton's The Life and Times of Bishop Challoner* (New York 1936).

CHALMERS, chā'mēr-z, Alexander, Scottish journalist and biographer: b. Aberdeen, Scotland, March 29, 1759; d. London, England, Dec. 10, 1834. Son of the founder of the first Aberdeen newspaper, he received a classical and medical education in his native city, and about 1777 went to London, where he became editor of the *Public Ledger* and *London Packet*, and a contributor to the *St. James's Chronicle*, the *Morning Chronicle*, the *Morning Herald*, and various critical magazines and reviews. In addition, Chalmers edited

the works of a number of English authors, including Henry Fielding, Samuel Johnson, Alexander Pope, Edward Gibbon, and Lord Bolingbroke (Henry St. John); and published an edition of Shakespeare with historical and explanatory notes (1809). He also published a *Glossary to Shakespeare* (1797). Of particular merit are *The British Essayists, with prefaces, historical and biographical, and a general index*, 45 vols. (1803), commencing with the *Tatler* and ending with the *Observer*; and *The English Poets from Chaucer to Cowper* (1810), an expanded version of Samuel Johnson's *Lives of the Poets*. Also among his literary labors was the *General Biographical Dictionary*, 32 vols. (1812-1817), the fullest body of biographical information published up to his time in England, which has rendered valuable service to subsequent compilers and students.

CHALMERS, George, Scottish antiquary: b. Fochabers, Moray, Scotland, 1742; d. London, England, May 31, 1825. Having studied law at Edinburgh, he went to Maryland in 1763, and practiced as a lawyer in Baltimore for 10 years until the American Revolution. Being a strong Loyalist, Chalmers returned to Great Britain, where in 1786 he was appointed clerk to the privy council for trade. Previous to this appointment he had published *Political Annals of the present United Colonies from the Settlement to the Peace of 1768* (1780); *An Estimate of the Comparative Strength of Great Britain during the present and four preceding Reigns* (1782); and *Opinions on Interesting Subjects of Public Laws and Commercial Policy Arising from American Independence* (1784). In 1790 he published a biography of Daniel Defoe. He also produced other biographies—among them one of Thomas Paine (1793) under the pseudonym of Francis Oldys—and edited the works of several Scottish writers, including Thomas Rudiman, Allan Ramsay, and Sir David Lindsay (Lyndsay of the Mount). The first volume of his *Caledonia* (1807) displayed vast erudition. Planned as a historical and topographical account of Scotland from the earliest to modern times, the second and third volumes appeared in 1820 and 1824, but the work was still unfinished when Chalmers died. He also wrote a *Life of Mary Queen of Scots* (1818), and left manuscripts for histories of Scottish poetry and printing.

CHALMERS, George Paul, Scottish painter: b. Montrose, Scotland, 1836; d. Edinburgh, Feb. 20, 1878. After serving under an apothecary and a ship chandler, he went to Edinburgh in 1853 to study painting under Robert Scott Lauder. The first picture he exhibited was *A Boy's Head*, done in chalk. Elected to the Royal Scottish Academy in 1867, he was made a full member four years later. His pictures, characterized by rich coloring, were at first mainly portraits, but the landscapes he produced later are now valued more highly. Among his canvases are *End of the Harvest* (1873); *Running Water* (1875); *Prayer* (1876); *Knitting* (1876); and the unfinished *The Legend* (in the National Gallery, Edinburgh, Scotland).

CHALMERS, James, Scottish bookseller: b. Arbroath, Angus, Scotland, Feb. 2, 1782; d. Dundee, Aug. 26, 1853. Taking a keen interest in public affairs, he played a part in post office

reforms. In 1834 he introduced adhesive postal stamps, an invention usually attributed to Sir Rowland Hill, who, however, gained acceptance for his project without knowing of Chalmers's previous efforts.

CHALMERS, James, Scottish missionary: b. Ardrishaig, Argyll, Scotland, Aug. 4, 1841; d. Goaribari Island, April 8, 1901. After early mission service in Glasgow, he was sent by the London Missionary Society to Rarotonga, Cook Islands, in the South Pacific in 1866. The natives came to be greatly devoted to him, and after ten years' enthusiastic work he received a more rigorous assignment among the savages of New Guinea, where he made many valuable explorations in the course of his missionary work. In 1890 he visited Samoa and met Robert Louis Stevenson, who wrote of him appreciatively. In 1901, with a brother missionary, Oliver C. Tomkins, he was killed by cannibals at Goaribari Island. Chalmers wrote *Work and Adventure in New Guinea* (1885); *Pioneering in New Guinea* (1887); and *Pioneer Life and Work in New Guinea* (1895). Consult also the posthumous *James Chalmers: his Autobiography and Letters* (1902).

CHALMERS, Sir Mackenzie Dalzell, British judge and parliamentary counsel: b. Nonington, Kent, England, Feb. 7, 1847; d. London, Dec. 22, 1927. Educated at King's College, London, and Trinity College, Oxford, he was called to the bar in 1869 and joined the civil service in India, where he served until 1872 and again from 1896 to 1898. Besides practicing law, he held public office as legal counsel, member of royal commissions, and judge, becoming first parliamentary counsel in 1902 and permanent under-secretary of state for the Home Department in 1903. Chalmers drafted important parliamentary acts pertaining to bills of exchange (passed 1882), sale of goods (passed 1894), and marine insurance (passed 1906). Among his writings is *Local Government* (1883).

CHALMERS, Thomas, Scottish theologian and social reformer: b. Anstruther, Fife, Scotland, March 17, 1780; d. Morningside, near Edinburgh, May 30-31, 1847. At the University of St. Andrews, where he was sent to study for the church, he became as much interested in mathematics as in divinity. In July 1799 he was licensed as a preacher, the rule of the Scottish church that a licentiate be 21 years of age dispensed with in his case, by virtue of his "rare and singular qualities."

In May 1803 he took up his duties at the parish of Kilmeny in Fife, and at the same time taught classes in mathematics and chemistry in the town of St. Andrews. He published *An Inquiry into the Extent and Stability of Natural Resources* in 1808, and in 1813 his notable article on Christianity appeared in the *Edinburgh Encyclopedia*. By that year his fame as a preacher had extended throughout Scotland, and the town council of Glasgow elected him to the charge of Tron parish, where he was inducted in 1815. In November he began a series of astronomical discourses which created a sensation and achieved a large sale when published in 1817. They made Chalmers the first preacher of his day, and when he went to London to lecture, the most distinguished statesmen and men of letters went to

hear him. Chalmers was also deeply concerned with the alleviation of poverty, for which he advocated voluntary charity instead of tax-paid public relief. His sociopolitical theories are formulated in *Political Economy in Connexion with the Moral State and Moral Prospects of Society*, 2 vols. (1832).

In 1823 he was elected to the chair of moral philosophy at St. Andrews, and in 1828 he accepted the chair of divinity in the University of Edinburgh, which he held until the disruption of the Established Church of Scotland in 1843. On this occasion he led the evangelical section in its withdrawal from the General Assembly, and is thus regarded as the founder of the Free Church of Scotland. He headed the Free Church College at Edinburgh from 1843 until his death. The social and religious movements he inaugurated left their mark far beyond the bounds of his own country. In his last years he completed the *Institutes of Theology*, his religious chef-d'œuvre. His extensive writings, ranging from natural theology, apologetics, and moral philosophy, to scientific, economic, and social subjects, were collected in 25 volumes during his lifetime. His son-in-law, William Hanna, published *Memoirs of the Life and Writings of Thomas Chalmers*, 4 vols. (1849-1852) and edited the *Posthumous Works of Dr. Chalmers*, 9 vols. (1847-1849).

Consult Watt, H., *Thomas Chalmers and the Disruption* (London 1943).

CHALMERS, chāl'mērzh, Thomas Hardie, American baritone, actor, and film producer: b. New York, N. Y., Oct. 20, 1884. After studying voice in New York, he went to Florence, Italy, in 1909, to study with Lombardi, and made his operatic debut as Marcello in *La Bohème* by Giacomo Puccini at Fossombrone, April 1911. He first sang in the United States with the Henry Savage Opera Company as Jack Rance in Puccini's *Girl of the Golden West* in 1911. After singing with other opera companies he made his debut at the Metropolitan Opera in December 1917 as Valentine in Charles François Gounod's *Faust*. Because of throat trouble which required an operation, he gave up his operatic career in 1922 and turned to the dramatic stage, appearing in Henrik Ibsen's *The Wild Duck* and other plays. From 1927 to 1938 he turned to motion pictures as a newsreel editor and producer of documentaries. Later he acted in such plays as *All My Sons* and *Death of a Salesman*.

CHALMETTE NATIONAL HISTORICAL PARK, shāl-mēt', just south of New Orleans, La., covers about 30 acres. The historical park commemorates the Battle of New Orleans, Jan. 8, 1815, when Andrew Jackson defeated the British (See NEW ORLEANS, BATTLE OF.) It consists of two sections, one of which includes part of the area where the battle was fought; some of the best works of the American line may still be seen there as well as the Chalmette Monument (begun 1855, completed 1908), a marble shaft approximately 100 feet high. The other section is occupied by the Chalmette National Cemetery (established 1861) with the graves of 14,000 Union soldiers.

Chalmette National Historical Park is named for its former owner, Ignace de Lino de Chalmette, who, although 60 years of age, reported for active duty to the American commander in the War of 1812. His own home had to be burned as

a war measure. The park was set up in 1907 as Chalmette Monument and Grounds, receiving its present name and status in 1939.

The adjoining village of Chalmette in St. Bernard parish on the east bank of the Mississippi has one of the largest sugar refineries in the world and manufactures petroleum products and oilfield equipment. Pop. (1950) 1,695.

CHALON, shā-lōn', Alfred Edward, English painter, younger brother of John James Chalon: b. Geneva, Switzerland, Feb. 15, 1780; d. Kensington, London, England, Oct. 3, 1860. Of French-Huguenot family, who settled in England in 1789, he joined his brother and others in founding the "Evening Sketching Society" in 1808. He won renown as a portrait painter in water colors and in 1816 he became a full member of the Royal Academy. Chalon was the first to paint a portrait of Queen Victoria after she acceded to the throne. An admirer of Jean Antoine Watteau, he also painted many canvases in oil, among them *Hunt the Slipper* (1831); *John Knox Reproving the Ladies of Queen Mary's Court* (1837), and *Sophia Western* (1857). Other works include a portrait of *Bulwer-Lytton* and illustrations for the novels of Sir Walter Scott.

CHALON, John James, English painter, brother of the former: b. Geneva, March 27, 1778; d. Kensington, England, Nov. 14, 1854. His family destined him for a career in business, but he early turned to art and studied at the Royal Academy in 1796. The first picture he exhibited was *Banditti at their Repast* (1800); another, *Napoleon on Board the Bellerophon* (1816), bequeathed to Greenwich Hospital, is probably his best known. Though primarily a painter of landscapes and genre scenes, he also excelled in figure painting, sketches, and marine subjects. He published the book *Sketches of Paris Manners* in 1820.

CHALON-SUR-SAONE, shā-lōn'sūr-sōn' (ancient CABBILLONUM), city, France, in the Department of Saône-et-Loire, located on the right bank of the Saône River at the terminus of the Canal du Centre (opened 1793), about 70 miles north of Lyon. It has a branch (*Petite-Creusot*) of the Schneider works of the Le Creusot engineering company, and is a transport and commercial center for wines, grains, and livestock. Its manufacturing establishments include machine shops, copper and iron foundries, glass and tile works, and shipyards for river boats. Printing, sugar refining, brewing, and tanning are carried on.

Under its ancient name Cabillonum it was a town of the Aedui, and Julius Caesar maintained grain magazines here. In the 6th century A.D. it was the capital of Burgundy. In 813 a church council was summoned here by Charlemagne. When King Edward I of England, returning from a crusade with 1,000 men-at-arms, attended a tournament at Chalon in 1273, a dispute arose, and the English attacked the French, killing a great number, and leaving the tilting ground strewn with the dead. This event is known as "the little war of Chalon."

The town suffered considerably from the civil wars of the 15th and 16th centuries, and from the invasion of the allies during the Napoleonic Wars in 1814. The bishopric was suppressed by

the French Revolution. Its ancient cathedral of St. Vincent, built mainly during the 12th and 15th centuries, was badly damaged in World War II, when Chalon lay on the border between occupied and unoccupied France. Pop. (1946) 32,683.

CHALONER, chāl'ō-nēr, Sir Thomas, English diplomat and poet: b. London, England, 1521; d. Clerkenwell, London, Oct. 14, 1565. After studying at both Oxford and Cambridge universities, he accompanied (1540) the British ambassador to the court of Emperor Charles V and thence to Algiers. He served as member of Parliament at various times from 1545 to 1555, and accompanied Edward Seymour, afterward duke of Somerset (known as the Protector), to Scotland, where he fought at the Battle of Pinkie (1547). Several embassies took him to Scotland and France, and under Queen Elizabeth he was sent (1558) on a mission to Emperor Ferdinand at Courtrai (Kortrijk) and to Philip II at Brussels. From 1561 to 1564 he was ambassador to Spain. Chaloner translated into English a homily of St. John Chrysostom (1544) and the *Praise of Folly* (1549) by Desiderius Erasmus. In addition he wrote verses and elegies in Latin, among them an elegy on Lady Jane Grey, first published in 1579. Hans Holbein, the Younger painted his portrait. His son, Sir Thomas Chaloner, the Younger (1561-1615), was a noted naturalist.

CHALONS-SUR-MARNE, shā-lōn'-sūr-mār-n', commune, France, capital of the Department of the Marne, about 25 miles southeast of Reims, located in the chalk country of the Champagne Pouilleuse, on the right bank of the Marne River and on its lateral canal. Once famed for its worsted cloth (*chalouns*), it is today a commercial center for champagne and cereals, and manufactures beer, barrels, leather goods, barbed wire, and wallpaper. Châlons-sur-Marne is also an important road, railway and canal center for northern France.

Its ancient name was Catalaunum, and it was fortified by the Romans. In 451 A.D. at the decisive BATTLE OF CHÂLONS, the Huns under Attila were defeated by Aëtius and Theodoric I on the nearby plains (Catalaunian Plain).

From the 10th century Châlons formed a kind of independent state governed by its bishops until 1360, when it was united to the French kingdom. The English laid siege to the city in 1430 and 1434. In 1870 the town was occupied by the Germans after Marshal MacMahon's withdrawal. The Germans held it again briefly in World War I (August to September 1914) before yielding it in Battle of the Marne. Its 13th-17th century cathedral and other historic edifices were damaged in World War II. Pop. (1946) 31,120.

CHALOSSE, shā-lōs', a historic region of Gascony, France. Situated along the Pyrenees in the country's southwest, it is traversed by the Adour River and now forms part of the Landes Department, of which it is the only productive farming district. The principal towns are Aire and Saint-Sever.

CHALOTAIS, La, French 18th century magistrate. See LA CHALOTAIS.

CHALUKYA, chā'lōok-yā, a Hindu dynasty

of the Deccan in central India, which flourished first from about 500 to 753 A.D. In approximately 550 it established its capital at Vatapi (now Badami) in what is today the Bijapur District of Bombay. The kingdom may be said to have been properly founded by Pulakesin I (550–566); it was expanded by his sons Kirtivarman I and Mangalesa, and reached its zenith under his grandson Pulakesin II (608 or 609–642), who about 611 started the dynasty of the Eastern Chalukyas (611–c.1078) by placing his brother Kubja Vishnuvardhana on the throne of Pishtapura and Vengi.

Pulakesin II sent an embassy to Khosrau II of Persia in 625 and enthroned one of his sons as head of a branch dynasty in south Gujarat. Both branches were continually at war with their neighbors, and in 642 Pulakesin was defeated by the Pallava king Mahendravarman I whose capital was Kanchi (now called Kanchipuram). Pulakesin's son and successor Vikramaditya I (655–680) re-established the Chalukya domain, which achieved new triumphs under the latter's great-grandson Vikramaditya II (733–746) who defeated the Pallavas. But his son, Kirtivarman II was overthrown by Dantidurga (Dantivarman II) of the Rashtrakuta dynasty about 753 or 754.

Another branch, the (Western) Chalukyas of Kalyani (or Kalyana) is generally considered to have been founded by Tailapa or Taila II in 973 and to have lasted until 1200 (or 1190).

The Chalukya-Chola Dynasty was founded by Rajendra III, king of Vengi (Eastern Chalukya dynasty), who took the vacant throne of Kanchi in 1074, assumed the name Kulottunga Chola I, and put a viceroy in Vengi. It lasted until 1267, when the empire was taken by the Hoysalas.

The Chalukyans developed an interesting style of architecture combining Indo-Aryan and Dravidian elements. It is represented by the star-shaped richly decorated shrine of Mysore with several cells combined into one temple. They also built many cave temples with cliff reliefs and stone sculptures.

CHALUMEAU, shà-lü-mō' (Fr., from the Latin *calamellus*, small reed or reed pipe), a reed instrument widely used in the 17th century, but now obsolete. It was the ancestor of the modern clarinet and was related to the shawm, forerunner of the oboe. The term chalumeau is used also to designate the lowest register of the clarinet and as a direction to play a passage an octave lower.

CHALYBEATE WATERS, kà-līb'ē-āt, those waters containing iron in sufficient quantity to warrant their usage in anemia. In the past such waters—also referred to as **IRON WATERS**—were considered of great value. Many thousands of patients suffering from anemia and debility traveled long distances to Saratoga, New York; Harrogate, Tunbridge Wells, and Bath, in England; and various European spas such as Kissingen, Germany, and St. Moritz, Switzerland, in the hope of securing relief through the medicinal properties of the waters. It is now known that iron is much better administered by the way of pills containing the salt in definite quantity, or by intravenous injections of iron preparations. As a consequence, the popularity of chalybeate waters has considerably diminished.

HAROLD WELLINGTON JONES, M.D.

CHALYBES, kal'i-bēz, an ancient people renowned for their metallurgical skill. Their exact habitat is still disputed, but they probably lived in northern Asia Minor along the Black Sea. Xenophon refers to them as living in the mountains between Armenia and Mesopotamia, and he seems—like several other authors of antiquity—to confuse them with the Chaldaeans. The Greeks considered the Chalybes the first workers of iron, and credited them with the invention of steel, which they called *chalybs* or *chalybos*.

CHALYBITE. See **SIDERITE**.

CHAM, chām, a Moslem tribe of Indochina now found mainly in the southern part of Annam and in Cambodia. Their physical features and language suggest an Indonesian origin, but traces of Indian and to a lesser extent Chinese influences are evident. Nominally Moslem, their religion is a mixture of Islam, Hinduism, Buddhism, and animism. The earliest Cham inscriptions date from the 4th century A.D. Around 1000 A.D. the Cham were in possession of a vast territory along the coastline of Annam, but they were later overwhelmed by their Annamese neighbors, and partly absorbed by them. They live on agriculture, and have developed a remarkable system of irrigation for their rice fields.

CHAM, kām (pseudonym of COUNT AMÉDÉE DE NOÉ), French caricaturist: b. Paris, France, Jan. 26, 1819; d. there, Sept. 5, 1879. Best known for his crayon contributions to *Charivari*, illustrated French periodical, he dealt lightly with familiar everyday things and events.

CHAMA, kâ'mâ, a genus of bivalve mollusks, the typical one of the family Chamidae. The shell has foliaceous valves, the upper one being the smaller, and one valve is attached to another body by the left umbo; the hinge tooth of the free valve is received between two teeth of the other. The chamas are found less than 50 fathoms deep in tropical seas, especially among coral reefs. As many as 50 recent species are known, and 40 fossil, the latter from the Cretaceous onward. The still existing *Chama gigas* sometimes weighs 300 pounds, and may measure four feet across. The byssus by which it adheres to the rock is so tough that a hatchet is required to cut it through. One valve is sometimes used in churches as a baptismal font.

CHAMACOCOS, chā-mā-kō'kōs, a nomadic Indian people of central South America, living in the Chaco of Paraguay, principally in the Olimpo Department of the country's northwest, west of the Paraguay River.

CHAMAEROPS, kâ-mē'rōps, a genus of palms of but one or possibly two species popularly called fan palms. This palm is extremely variable in appearance and size; the trunks may be clustered and are then about three feet high. Single trunks, however, reach 20–30 feet high. The leaves are fan shaped, and the leaf stalks usually bear spines. *Chamaerops humilis* is the only palm native to Europe, where it occurs in the Mediterranean region. It is cultivated in California and in the Gulf coast region of the United States, and in greenhouses elsewhere. A fiber obtained from the leaves is used for padding mattresses.

CHAMALHARI, peak in the Himalayas. See **CHOMO LHARI**.

CHAMAN, chǎ'mūn, town, Pakistan, located in northeastern Baluchistan on the Afghanistan border near Chaman Pass and about 60 miles northwest of Quetta. It is an important border station and rail terminus. Cantonment pop. (1941) 6,650.

CHAMARS, chá-märs' (from Sanskrit *car-makāra*, leather worker), a low caste of India having considerably more than 10,000,000 members who live chiefly in the country's north and in Nepal. Their traditional trade is tanning and related leather work, but they perform also other menial labors for high-caste Hindus; a great many have become farmers.

CHAMARTIN DE LA ROSA, chā-mār-tēn' dā là rró'sā, suburb of Madrid, Spain, until 1947 a separate municipality (1940 pop., 64,485), located to the north of the capital. Chamartin has important mechanical industries; there is a Jesuit college and the palace of the dukes of Osuna. Among its sections are Tehuán de las Victorias, Ciudad Lineal, and Castillejos.

CHAMAVI, kâ-mā'vī, a Germanic tribe that occupied roughly the present Netherlands about 100 A.D. The Chamavi fought together with the Cherusci against the Romans, but were later absorbed by the Franks, although they retained their own law code, the *Lex Chamavorum*.

CHAMBA, chūm'bā, district and town, India, in northern Himachal Pradesh. The district is bordered on the north and west by Kashmir, and on the south by the Punjab of India; it is a mountainous region in the Himalaya foothills; area, 3,127 square miles; pop. (1941) 168,908. Its capital, Chamba, is a trade center, pop. (1941) 6,597.

CHAMBAL or **CHUMBUL**, chūm'bāl, un-navigable river, chief tributary of the Jumna, in west-central India; it is subject to sudden floods during the rainy season. Length, about 550 miles.

CHAMBELLAN, chām'bēl-lān, **Rene Paul**, American sculptor: b. West Hoboken, N. J., Sept. 15, 1893. After studying at the École Julian in Paris and with Solon Hannibal Borglum, he served with the United States Army in France during World War I, and worked with Borglum on the Pershing Stadium at Vincennes, France, before returning to the United States where he taught sculpture at New York University. His artistic work has been devoted, in the main, to decorating buildings with sculptured groups, figures, and plaques—notably at Yale University, Rockefeller Center, several state offices in New York and Buffalo, the Chicago Tribune Building, the Crowell-Collier Building in New York, and the New York World's Fair. In addition, he has designed several medals, such as the Iwo Jima commemorative.

CHAMBER, a term having various technical meanings. The chamber of a cannon is that part of the bore which receives the powder with which it is charged.

The chamber of a mine is the place where the

charge of powder is lodged that is to be used for exploding the mine.

In several languages, the term chamber is employed to designate a branch of government whose members assemble in a common hall.

A chamber of commerce is a board or association formed to promote the interests of trade and merchandising. See also **CHAMBERS OF COMMERCE**.

CHAMBER MUSIC (Ger. *Kammermusik*, Ital. *música da cámara*), instrumental music of an intimate character, written for performance by two or more players, in which no part is a solo with accompaniment, but all parts are of equal importance. The term implies that chamber music is suitable for performance in a room or in a medium-sized auditorium. Actually, the name became current in the early 17th century, when it was used to distinguish secular from sacred music.

Origins of Chamber Music.—In its beginnings, chamber music flourished as a result of the patronage of the aristocracy; where such noble support was uncertain, the cultivation of this art was less general. In Italy, for example, Arcangelo Corelli (1653–1713) lived and worked under the protection of Cardinal Pietro Ottoboni; he was, therefore, a leader in the group of chamber music composers which included Antonio Vivaldi. Henry Purcell, in England, worked more or less individually, and his chamber music works are isolated examples of great genius.

George Frederick Handel and Johann Sebastian Bach owed the form of their chamber music works to the 17th century Italians, although Handel, without aristocratic patronage, produced comparatively little chamber music, other than his violin sonatas. Bach, however, during his Köthen period (1717–1723), when he was Kapellmeister and director of Kammermusik to Prince Leopold of Anhalt, produced a whole catalogue of sonatas and suites for small instrumental combinations.

Chamber Music Development.—Starting with Joseph Haydn, the development of chamber music was carried on most effectively by German and Austrian composers, from the date (c.1755) of Haydn's first chamber music work, to the death of Johannes Brahms (1897). Haydn enjoyed the patronage of Prince Miklós József Esterházy, and his genius flourished under the conditions in which he worked. His contribution was not only the establishment of the sonata form as the framework for all instrumental chamber music, but also the development of the string quartet and other works for chamber music combinations as balanced conversation between the instruments.

Mozart continued Haydn's patterns and gave to the instruments still more independence, and to his works a deeper emotional significance. Ludwig van Beethoven, presaging the advent of the romantic school (Franz Schubert, Robert Schumann, and others), added further breadth and independence to the string quartet; many scholars feel that chamber music has not advanced very far since his time, although Brahms, considered by many to be more classicist than romanticist, surely added many imposing works to the repertoire.

Almost every composer has written works for various chamber music combinations; and, with certain of the romanticists, the introduction of the piano, and the vogue of the piano quintet (string quartet and piano), seem to indicate that

the composers of these works (Robert Schumann, César Auguste Franck, and others), were writing more for the concert hall than for private performances in the home or the studio.

Modern Chamber Music Composers.—More recent composers, likewise, have found the chamber music forms an effective medium. The French impressionists, Claude Debussy and Maurice Ravel, composed works which are truly chamber music, in spirit, even though their effectiveness is based on atmospheric harmony and timbre, rather than on design and form. Still more recently, many contemporary composers have reverted, somewhat, from the exploitation of the more colorful tonal textures of works such as Arnold Schönberg's *Verklärte Nacht*, and have returned to the more objective types of absolute, as opposed to program (descriptive), music. This is particularly true of the neoclassic composers, who turn to the contrapuntal devices of the past, and adapt them to more contemporary idioms.

Wind and String Instrument Combinations.—Although string instruments have always been the bulwark of chamber music combinations, wind instruments (especially wood winds and French horns) have often been added to the ensemble combinations (Mozart's quintet for clarinet and string quartet; Brahms' horn trio for violin, horn, and piano; and others). In addition, numerous chamber music works have been composed for combinations of wind instruments only; and, occasionally, for brass instruments.

Consult Cobbett, W. W., *Cyclopedic Survey of Chamber Music* (London 1929-30); Kilburn, N., *Chamber Music and its Masters in the Past and in the Present* (London 1932); Ulrich, H., *Chamber Music: The Growth and Practice of an Intimate Art* (New York 1948); Rowen, R. H., *Early Chamber Music* (New York 1949).

JOHN TASKER HOWARD.

CHAMBER OF COMMERCE OF THE UNITED STATES, a federation of commercial organizations and trade associations, formed in 1912 on the recommendation of President William Howard Taft, to help Congress "keep in closer touch with commercial affairs." It has its headquarters in Washington, D.C.

The National Chamber, as it is widely called, is composed of more than 3,100 affiliated organizations—local, state, and regional chambers of commerce, and trade and industrial associations. There are more than 21,000 business members, including firms, corporations, and individuals. Its underlying membership, that is the membership of its affiliated organizations, is more than 1,600,000.

The chamber carries on its work by (1) studying national economic problems and defining current questions; (2) ascertaining the views of business, and determining what business feels is the best solution to a national problem; and (3) voicing and explaining the views of business to the public and to the government.

The policies of the chamber represent the majority opinions of its members. A proposed policy must be "national in character, timely in importance, and general in application to business and industry." A chamber policy may be adopted in one of the three following ways: (1) by vote of delegates at an annual meeting; (2) by referendum of affiliated organizations; and (3) in an emergency, by the board of directors. Unless reaffirmed, a chamber policy automatically expires three years after adoption.

The chamber maintains division offices in New York City, N. Y.; Atlanta, Ga.; Dallas, Texas; Minneapolis, Minn.; Chicago, Ill.; and San Francisco, Calif. The work of the organization is governed by a board of directors, made up of 50 members elected by the affiliated organizations. Staff activities are carried out through 13 specialized departments, three member-organization service departments, and four coordinating and operating departments.

The specialized departments deal with national issues and organization policies, and are: agriculture, construction and civil development, domestic distribution, finance, foreign commerce, foreign policy, insurance, manufacture, natural resources, transportation and communication, economic research, education, and labor relations. The service departments are: chamber of commerce service department, state chamber of commerce department, and trade association department. The coordinating and operating departments are: information department, legislative department, membership sales department, and *Nation's Business* magazine department.

The National Chamber publishes *Nation's Business*, a general business monthly, circulation about 800,000; *Washington Report*, a weekly newspaper for distribution to members, libraries, public officials, and the press; *Legislative Daily*, a summary of congressional action; *Legislative Outlook*, published every two weeks when Congress is in session; and departmental newsletters and numerous research studies and reports.

CHAMBER OF DEPUTIES, the lower of the two legislative chambers or second house of the national Parliament in France, Italy, and other countries. The first French Chamber of Deputies was established under Louis XVIII in 1814. By enactment introduced in 1830, any citizen of 30 years and upward who paid direct contributions to the extent of 500 francs, might be elected as a deputy. Originally the chamber was elected for five years: in 1824 it became septennial and in 1830 it was again limited to five years. Under the Constitution of 1875 of the Third Republic, the Chamber of Deputies was elected for four years by manhood suffrage. The manner of election of deputies has been modified several times. The *scrutin de liste*, under which each elector votes for as many deputies as the entire department has to elect, was introduced in 1871. In 1876 it was replaced by the *scrutin d'arrondissement*, under which each department is divided into a number of *arrondissements*, each elector voting for one deputy only. In 1885 there was a return to the *scrutin de liste*; in 1889 the uninominal vote was reintroduced.

On Oct. 13, 1946 the constitution prepared by the National Constitutional Assembly was adopted by popular vote and the Fourth Republic came into being on Dec. 24, 1946. The name of the lower house was changed from Chamber of Deputies to National Assembly. This body is elected by equal, direct, and secret universal suffrage for a five-year term unless earlier dissolved. Dissolution is possible only after two cabinet crises within 18 months after the National Assembly has been in existence for 18 months. The National Assembly exercises more power than did the Chamber of Deputies under the Third Republic. The upper house, no longer called the Senate but the Council of the Republic, has only consultative powers.

The present electoral law adopted in 1951, replacing that of 1946, compromises between proportional representation under the *scrutin de liste* and the single-member district or *scrutin d'arrondissement*, with the object of discriminating in favor of the center parties and against both the Communists at the extreme left and the Gaullists at the right. In the election of June 1951, the center parties sustained their majority in the National Assembly, which has a total membership of 627 deputies.

In Italy, under the constitution of 1948, the Chamber of Deputies is composed of 574 members elected for five years unless the chamber is dissolved. In both France and Italy, deputies must be 25 years old, and receive compensation for their services.

QUINCY WRIGHT.

CHAMBERLAIN, chām'bēr-līn, (Arthur) Neville, British statesman: b. Birmingham, England, March 18, 1869; d. Heckfield, Hampshire, Nov. 9, 1940. The second son of Joseph Chamberlain and half brother of Sir (Joseph) Austen Chamberlain, he was educated at Rugby and Mason College, Birmingham. From 1890-1897 he resided in the Bahamas, managing a plantation. In 1911 Chamberlain became a member of the Birmingham City Council and 1915-1916 he was lord mayor of Birmingham. He entered Parliament in 1918 and after 1922 held various cabinet posts, including chancellor of the exchequer from 1931 until May 28, 1937, when he succeeded Stanley Baldwin as prime minister.

Almost immediately his ministry faced difficulties created by the Spanish Civil War and the Sino-Japanese conflict. To protect Britain's interests in the Mediterranean, he negotiated a treaty with Italy ratifying the Ethiopian conquest on condition that Italy withdraw from Spain. In 1938 he signed the Munich Pact with Italy, France, and Germany, under which certain areas of Czechoslovakia were surrendered to Germany in the hope of preserving what he called "peace in our time." Six months later Adolf Hitler had broken the agreement, and Chamberlain tried to change his policy, saying that England would not allow any further German aggression. He failed, however, to form an alliance with Russia, the one country which might have been able to help Britain block German designs on Poland.

Chamberlain was forced to lead his country into war on Sept. 3, 1939, after the Russo-German agreement of the preceding month had made it possible for Germany to invade Poland. For the next eight months he remained at the head of the government, but growing criticism of his war policies culminated in his resignation on May 10, 1940, after the German invasion of France. Succeeded by Winston (later Sir Winston) Churchill as prime minister, he became lord president of the council. He remained in the cabinet until October 3, when he resigned because of ill health.

CHAMBERLAIN, Austen. See CHAMBERLAIN, SIR JOSEPH AUSTEN.

CHAMBERLAIN, Charles Joseph, American botanist: b. Sullivan, Ohio, Feb. 23, 1863; d. Chicago, Ill., Feb. 5, 1943. He graduated from Oberlin College in 1888, then taught in Ohio and Minnesota until 1893, when he entered the University of Chicago, graduating as doctor of philosophy in 1897. He remained at this institution

until his retirement in 1929, serving as professor of plant morphology and cytology after 1915.

His interest in morphology and cycads took him on several expeditions to the tropics of southern Mexico, and trips to Cuba, New Zealand, Australia, and Africa. Among his published works are *The Morphology of Spermatophytes* (1901) and *The Morphology of Angiosperms* (1903), both with John M. Coulter (q.v.); *Elements of Plant Science* (1930); and *Gymnosperms, Structure and Evolution* (1935).

CHAMBERLAIN, Daniel Henry, American politician: b. West Brookfield, Mass., June 23, 1835; d. Charlottesville, Va., April 13, 1907. He graduated from Yale College in 1862, attending Harvard Law School the following year. After serving as an officer during the Civil War, he settled in South Carolina, and was state attorney general in 1868-1872. He was elected governor of South Carolina in 1874 and again in 1876. However, his reelection was contested by Wade Hampton, the Democratic candidate. President Rutherford B. Hayes conferred with both men in Washington, and the United States troops which had been in South Carolina supporting Chamberlain were withdrawn, whereupon Chamberlain relinquished his claim to the election. He moved to New York and opened law offices there. After traveling in Europe and Egypt he settled in Virginia in 1906.

CHAMBERLAIN, George Earle, American politician: b. near Natchez, Miss., Jan. 1, 1854; d. Washington, D.C., July 9, 1928. He graduated from Washington and Lee University in 1876, and started law practice in Oregon. There he became a state legislator, state attorney general, and governor (1902-1909). From 1909 to 1921 he was United States senator from Oregon, serving as chairman of the Military Affairs Committee after 1913 and aiding legislation dealing with the draft, food control, and war financing. He bitterly criticized the War Department for delays in the early months of World War I. Defeated for re-election in 1920, he was appointed a member of the United States Shipping Board.

CHAMBERLAIN, Houston Stewart, Anglo-German author: b. Southsea, Hampshire, England, Sept. 9, 1855; d. Bayreuth, Germany, Jan. 9, 1927. Educated in France and England, he went to Germany in 1870 to study German culture and came to believe that European civilization owed most to German contributions. In 1908 he married Eva, daughter of Richard Wagner, as his second wife. His book *The Foundations of the Nineteenth Century* (1911), won acclaim in Germany for its scholarly advocacy of German superiority, but was condemned elsewhere for its nationalist prejudices. Among his other works are *Richard Wagner* (1897); and *The Wagnerian Drama* (1915).

CHAMBERLAIN, Jacob, American missionary: b. Sharon, Conn., April 13, 1835; d. Madanapalle, Madras, India, March 2, 1908. He graduated from Western Reserve College in 1856 and the Dutch Reformed Theological Seminary at New Brunswick, N. J., in 1859, then studied medicine at the College of Physicians and Surgeons, New York City. In 1860 he went to India, establishing hospitals at Madanapalle in 1868 and at

Palamanair 1872. He translated the Reformed Church liturgy into Telugu Madras (1873), and also *Hymns for Public and Social Worship* (1884). He wrote *The Bible Tested* (1878; 7th ed., 1885); *Native Churches and Foreign Missionary Societies* (1879); *Winding up a Horse; or Christian Giving* (1879); *Break Cocoanuts Over the Wheels; or All Pull for Christ* (1885); *The Kingdom in India: Whose?* (1907); *The Cobra's Den and Other Stories of Missionary Work among the Telegus of India* (1900).

CHAMBERLAIN, John Loomis, American army officer: b. Livonia, N. Y., Jan. 20, 1858; d. Washington, D.C., Nov. 5, 1948. He was graduated at the United States Military Academy in 1880. For years he was an officer of the line. He was graduated from the Army Service School, the Artillery School at Fort Monroe and the Army War College, and for four years (1884-1888) he was an instructor at the Military Academy, West Point. In the winter of 1890-1891, while a junior officer in the service, he took an active part in the campaign against the Sioux Indians. In 1891-1893 he was chief ordnance officer of the Missouri department and in 1895-1896 served as instructor in military science and tactics at the Peckskill Military Academy. In 1897-1898 he was appointed military attaché at Vienna, but resigned this post on the outbreak of hostilities with Spain. Throughout the war he served as a major of United States Volunteers with the Seventh Army Corps. In 1900 he became a major in the inspector-general's department through a competitive examination, open to all captains of the line. He investigated the Pacific transport service in 1901, the result being a complete reorganization of the personnel. He spent five years service in the Philippines and in the course of his duties he also visited China and Japan. In 1913 his investigation of the aviation section of the Signal Corps resulted in changes of policy and a reorganization of the service. In February 1917 he was appointed inspector general, with the rank of brigadier general, and on Oct. 6, 1917 major general. He made a tour of inspection of the American Expeditionary Force in France in 1918; of all war department activities in Great Britain and Europe in 1920; and in Europe, the Middle East and Africa in 1921. He retired Nov. 6, 1921.

CHAMBERLAIN, Joseph, English statesman: b. London, July 8, 1836; d. Birmingham, July 2, 1914. He was for a time at University College School, London, and in 1854 he entered into partnership with his cousin, Joseph Nettlefold, as a screw manufacturer in Birmingham—a business in which his father was also interested. He retired from active business life in 1874 after having amassed a handsome fortune. He was by this time coming to the front as the "rising hope" of the advanced Radicals. As a member of the Birmingham School Board, and its chairman from 1874 to 1876, he took up an attitude of uncompromising hostility to the denominational school system. In 1869, he was elected a member of the Birmingham Town Council. His tenure of the mayoralty (1874-1876) was notable for sweeping reforms; new municipal buildings were built, the gas and water undertakings were municipalized and a great city improvement scheme was successfully carried out. After an unsuccessful parliamentary contest at Sheffield

in 1874, he was in 1876 returned unopposed for Birmingham. He rapidly made his mark in Parliament; he infused new life into the Radical organization, and on the return of the Liberals to office in 1880 entered the Cabinet as president of the Board of Trade. To Mr. Chamberlain's exertions was due the passing of an important bankruptcy act, and his attempt to amend the merchant shipping acts, though unsuccessful, formed the basis of later legislation. His influence meantime was rising in the country; he stood out as an opponent of "coercion" in Ireland and favored a large measure of self-government, and in the election of 1885 he preached the doctrine of "ransom" and the "restitution" of property with a frankness that alarmed moderate Liberals, and enunciated an "unauthorized program" which included free education, small holdings, and a graduated system of taxation. After that election and the subsequent defeat of the Salisbury ministry and when the tenure of the Liberal government in office depended on the Irish vote and a Home Rule measure became imminent, he accepted the presidency of the Local Government Board, but resigned on March 15, 1886 on account of hostility to Mr. Gladstone's Home Rule Bill of that year. With the other "dissentient Liberals" he voted against that measure and assisted materially in the defeat of the Liberals at the polls at the ensuing general election. For a time it seemed as if the breach in the Liberal ranks might be healed, but after a Round Table conference in 1887 it grew wider and Mr. Chamberlain became the object of intense dislike on the part of the Home Rule Party. He held no office in the Unionist administration from 1886 to 1892, but his influence was felt in legislation, and he succeeded in getting some radical measures passed, such as free education. As a member of the commission to settle the fisheries dispute with Canada, he visited Washington in 1887 and succeeded in negotiating the Chamberlain-Bayard Treaty, which however was refused ratification by the United States Senate. Another result of his visit was that he married in 1888, as his third wife, Mary, daughter of William C. Endicott, Secretary of War in President Cleveland's first administration.

On the elevation of Lord Hartington (Victor Christian William Cavendish) to the House of Lords as the 9th duke of Devonshire in 1891, Mr. Chamberlain succeeded to the leadership of the Liberal Unionists in the House of Commons. During the passage of Mr. Gladstone's second Home Rule Bill (1893) through the House of Commons, Mr. Chamberlain was the life and soul of the opposition, his discussion of the various amendments being marked by a masterly debating power and keen analytical skill. On the return of the Unionists to power in 1895 he was appointed Secretary for the Colonies. His tenure of that office may be said to have been the turning point in the relations of the colonies with the mother country; his sympathetic understanding of colonial aspirations was soon apparent, and his talents as a business man and skill in administration found a fruitful field. When the "Jameson Raid" occurred in the Transvaal, he at once repudiated all connection with it on the part of the British authorities, and he subsequently denied in the most distinct manner having had any personal foreknowledge or suspicion of what was about to take place. The country was sharply divided on his conduct of the negotiations preceding the outbreak of the

war with the South African Republic in 1899, but his influence in the country was a main cause in the Unionist triumph in the election in 1900. On the conclusion of hostilities he visited South Africa and personally initiated the measures adopted to repair the ravages of war. His influence was manifest in the provisions of the Workmen's Compensation Act of 1897, and he carried through the Australian Commonwealth Bill in 1900.

In 1903 he launched another "unauthorized program," which aimed at the reversal of the traditional free trade fiscal policy of Great Britain and at the setting up of preferential tariffs within the Empire, and he resigned his place in the Cabinet the better to pursue this missionary enterprise. He found support from the majority of the Unionist party; but a powerful minority, including such distinguished men as the duke of Devonshire, George Joachim Goschen, and Earl St. Aldwyn, stood for the old policy; Arthur James Balfour, on whom devolved the duty of keeping his party together, gave to "tariff reform" but a dubious and hesitating support; the Unionist party was rent in twain; and at the general election of 1906—at which Chamberlain's policy was only one among other issues—the Unionist government suffered a disastrous defeat. Chamberlain from 1903 had been conducting a strenuous campaign on behalf of "tariff reform" that had severely taxed his strength, and his last years were spent as an invalid; but from time to time he continued to inspire his followers with messages in the press.

He was the first purely business man, untaught in any of the universities, to rise to a commanding place in British public life, and he profoundly affected the style of debating in the House of Commons. In his talents as an administrator, in his capacity for getting through business, he was almost unrivaled. As a debater he was cool and resourceful, never so dangerous as when fighting in a disadvantageous position. He had, as Lord Morley said, a "genius for friendship," as demonstrated by the fidelity of his West Birmingham constituents over a period of nearly 40 years.

Consult biographies by Marris, N. M. M., *Joseph Chamberlain, the Man and the Statesman* (London 1900); Creswicke, L., *Life of Joseph Chamberlain*, 4 vols. (London 1904); Jeyes, S. H., *Mr. Chamberlain, His Life and Public Career*, 2 vols. (London 1904); Mackintosh, A., *Joseph Chamberlain; an Honest Biography* (London 1906); Garvin, J. L., *Life of Joseph Chamberlain*, 3 vols. (London 1932-1934).

CHAMBERLAIN, Sir Joseph Austen, British statesman: b. Birmingham, Oct. 16, 1863; d. London, March 16, 1937. Eldest son of Joseph Chamberlain and half brother of Arthur Neville Chamberlain (q.v.), he was educated at Rugby and at Trinity College, Cambridge, and later studied in Berlin and Paris. Elected to Parliament in 1892 he entered on a distinguished career in which he filled numerous government posts, the most important of which were the chancellorship of the exchequer (1903-1906 and 1919-1921) and the foreign secretaryship (1924-1929) in the Cabinet of Stanley Baldwin (q.v.). His direction of post-World War I financial policies contributed substantially to paying off Britain's indebtedness and strengthening foreign credits. Chamberlain's conduct of foreign affairs significantly led to the signing of the Locarno Pact (see LOCARNO, PACT OF) and he was accorded recognition in 1925 when he shared the Nobel

Peace Prize with Charles Gates Dawes (q.v.). He also received considerable credit for Germany's entrance into the League of Nations, whose council and assembly meetings he frequently attended. In 1921 Chamberlain was Conservative leader of the House of Commons and advocated the creation of the Irish Free State. He retired as first lord of the admiralty and from active political life in October 1931. Chamberlain's published works include *Peace in Our Time* (1928), *Down the Years* (1935), *Politics from Inside* (1936), and *Seen in Passing* (1937).

Consult Petric, Charles, *Life and Letters of Sir Austen Chamberlain* (Toronto 1939-1940).

CHAMBERLAIN, Joshua Lawrence, American soldier and educator: b. Brewer, Me., Sept. 8, 1828; d. Feb. 24, 1914; graduated Bowdoin College 1852 and Bangor Theological Seminary 1855; professor of rhetoric and oratory, Bowdoin, 1856, and in 1861 professor of modern languages of Europe. On Aug. 8, 1862, he entered the army as lieutenant-colonel of volunteers and served through the Civil War in the Army of the Potomac in every campaign, and was several times wounded, twice severely. He received the Congressional Medal of Honor for his remarkable conduct in the defense of Little Round Top, Gettysburg, July 2, 1863, and was advanced to the command of a brigade. On June 18, 1864, he was promoted brigadier-general on the field by General Grant for distinguished gallantry in leading a desperate charge, and early the following spring he received a special promotion as brevet major-general. In the campaign of 1865 he commanded two brigades of the 1st Division, 5th Corps. In the order disbanding that army he was retained in the service and was offered a colonelcy in the regular army, but the condition of his wounds induced him to decline the service, and in January 1866 he returned to Maine.

In the autumn of that year he was elected governor of Maine, and served in that office for four terms. In 1871 he was chosen president of Bowdoin College, and continued in that position for 12 years, his administration being marked by a broadening of the course and a large increase in the resources of the college. During this time he was elected major-general of Maine, to command the militia of the state. In 1879, when for a time there was no active or legal state government, he was called to the capital "to preserve the peace and institutions of the state." This he accomplished without the use or show of military force. In 1883 he retired from the presidency of Bowdoin and settled in New York to practise law. In 1884 he went to Florida and engaged in the work of railroad building and public improvements on the West Coast. He published *Maine, Her Place in History* (1877); *Ethics and Politics of the Spanish War* (1898); *De Monts and Acadia* (1904); *Ruling Powers in History* (1905); *The Passing of the Armies* (1915). He also edited *Universities and Their Sons* (1898).

CHAMBERLAIN, Mellen, American lawyer, librarian, and historian: b. Pembroke, N. H., June 4, 1821; d. Chelsea, Mass., June 25, 1900. He was graduated at Dartmouth College in 1844 and at the Harvard Law School in 1848. In 1849 he was admitted to the bar, opened a law office in Boston, and made his residence in

Chelsea, where he served the town in many public capacities the remainder of his life. In 1858 and 1859 he was a member of the Massachusetts General Court and the senate in 1863-1864. He was associate justice of the municipal court of Boston 1866-1870, and chief justice 1870-1878. In August 1878 he was chosen librarian of the Boston Public Library, serving until ill health compelled his retirement in 1890. During his administration the new library building was begun and the cornerstone laid. Throughout his life he was a close student and investigator of American history.

Besides important chapters in Justin Winsor's *Narrative and Critical History of America*, vol. 6 (1888), he wrote *John Adams, the Statesman of the American Revolution, with Other Essays and Addresses, Historical and Literary* (1890), edited by Lindsay Swift.

CHAMBERLAIN, Montague, Canadian American naturalist: b. Saint John, New Brunswick, April 5, 1844; d. 1924. He was educated privately, both his parents being teachers. Though engaged in mercantile pursuits, he devoted much time to the study of natural history and came to be well known as an ornithological writer. In 1889 he became assistant secretary of the Lawrence Scientific School of Harvard University, and from 1893-1900, secretary.

A member of several scientific bodies, his chief publications are *Canadian Birds* (1870); *Birds of New Brunswick* (1882); *Mammals of New Brunswick* (1884); *Systematic Table of Canadian Birds* (1887); *Birds of Greenland* (1892); *Some Canadian Birds* (1895); *The Church Army* (1897); *Maliseet Vocabulary* (1899); and *The Penobscot Indians* (1899).

CHAMBERLAIN, Nathan Henry, American clergyman: b. Bourne, Mass., Dec. 25 or 28, 1828-1830?; d. there, April 1, 1901. He graduated at Harvard, 1853, and studied theology at the divinity school there, and at Heidelberg, Germany, eventually becoming a Unitarian minister. He was pastor at Canton, Mass., 1857-1859, and at Baltimore, Md., 1860-1863. He then took orders in the Episcopal Church and became rector at Birmingham, Conn., 1864-1867; subsequently serving in New York, Wisconsin, and Massachusetts. He then retired to devote himself to literary pursuits. His books are *Autobiography of a New England Farm House* (1864); *The Sphinx in Aubrey Parish* (1889); *What's the Matter? or Our Tariff and its Taxes* (1890); *Samuel Sewall and the World He Lived In* (1897), an admirable study of colonial life in New England; *Sir Charles Napier; An Itinerary of Cape Cod*.

CHAMBERLAIN, Neville. See CHAMBERLAIN, ARTHUR NEVILLE.

CHAMBERLAIN, Samuel Selwyn, American journalist: b. Walworth, N. Y., Sept. 25, 1851; d. San Francisco, Calif., Jan. 25, 1916. He was graduated from New York University in 1871 and entered the journalistic field with the *New York Herald*. He went abroad with James Gordon Bennett of the *Herald* and was for a time editor of the Paris edition of that journal. In 1879 he became editor of the *World* but left to take charge of the *Evening Telegram* in 1881. He founded *Le Matin* of Paris in 1884 and

edited it for two years and then returned to the United States.

In 1889 William Randolph Hearst engaged him as editor of the San Francisco *Examiner* and he remained on the Pacific coast until 1895, when he came to New York as editor of the *Evening Journal*. In 1900 he became managing editor of the Philadelphia *North American*, which soon resumed its old place among the successful publications of that city. In a year or two Mr. Chamberlain returned to the Hearst service, and until his death acted as general staff officer. He went to the Chicago *Examiner*, was recalled to the New York *American*, and for several years, until the spring of 1915, had been the Hearst representative in London. His last work was editor of the Boston *American*. He was recognized as an exceptionally able newspaper man; his forte was a news touch of charming delicacy; he had unerring news perception and understood and carried out feature ideas that were distinct.

CHAMBERLAIN, chām'bēr-līn, city, South Dakota, seat of Brule County; altitude 1,360 feet; on the Missouri River about 10 miles north of its confluence with the White River; on the Chicago, Milwaukee, St. Paul and Pacific Railroad; about 65 miles west of Mitchell. It is a stock-raising and dairying center. Nearby is a large deposit of manganese. The area was explored by the French, and Lewis and Clark were here in 1804.

Immediately north of the city are the Crow Creek and Lower Brule Indian reservations. The city was incorporated in 1881. Pop. (1940) 1,626; (1950) 1,912.

CHAMBERLAIN (ME. from OF. *Chamberlenc*; OHG. *chamarling* fr. G. *kammer* fr. L. *camera*, chamber), court officer, originally employed, as the name indicates, to take charge either of the private apartments of a prince, or of a treasury. The golden key, which is worn by the chamberlains of the European courts on two small golden buttons (as well as the buttons themselves, when the key is omitted), indicates also the origin of the office. At present the employment of chamberlains (when their office is not merely nominal) is to attend on the persons of the princes and their consorts. There is generally a chief or high chamberlain. This officer in England is called Lord Great Chamberlain of England. His office is one of great antiquity and honor, being ranked as the sixth great office under the English crown. It is entirely distinct from that of Lord Chamberlain of the Household (see below).

To the Lord Great Chamberlain belong lodging and livery at the king's court; and there are certain fees due to him from each archbishop and bishop when they perform their homage to the king; and from all peers at their creation on doing their homage. On the coronation day, this officer is to bring the king his shirt, coif, and wearing apparel, and after the king is dressed, he claims his bed and all the furniture of his chamber for his fees; he also carries at the coronation the coif, gloves and linen to be used by the king on that occasion; also the sword and scabbard, the gold to be offered by the king, and the robes royal and crown; dresses and undresses the king on that; waits on him before and after dinner, etc. This

officer has also the care of providing all things in the House of Lords during session; the government of the palace of Westminster; and the disposal of the sword of state, when carried before the king, to any lord of his choice. The office of lord great chamberlain of England is hereditary, descending from a grant of Henry I (r. 1100–1135) through the family of De Vere, earls of Oxford. The holders in the reigns of George VI and Elizabeth II were the earls of Ancaster and the marquesses of Cholmondeley, who take it in turn. At the beginning of Elizabeth II's reign (1952) it was held by George Horatio Charles Cholmondeley, the 5th marquess. During a queen's reign some of his duties, especially at the coronation, are shared by a mistress of the robes.

The lord chamberlain of the household is an officer who has the oversight and direction of all the officers belonging to the king's or queen's chambers, except the precinct of the bedchamber. To his department belong the two drama censors, called "examiners of plays."

The chamberlain of London receives and keeps the city money which is stored in the chamber of London; he also presides over the affairs of masters and apprentices, and admits duly qualified persons to the freedom of the city. His tenure of office is for a year, like that of the lord mayor, but he usually is re-elected.

At all monarchical courts there are almost as many different chamberlains as there are kinds of chambers; the English chamberlains here cited, and their duties, may be taken as typical.

CHAMBERLIN, chām'bēr-lin, **Thomas Crowder**, American geologist: b. Mattoon, Ill., Sept. 25, 1843; d. Chicago, Ill., Nov. 15, 1928. After graduating from Beloit College in 1866 and pursuing his studies at the University of Michigan, he became a professor first at the State Normal School, Whitewater, Wis., and from 1873 to 1882 at Beloit, where he began his great work on the studies of glacial deposits with relation to climatic conditions in past geological ages. This took him to Switzerland in 1878. After publishing *The Geology of Wisconsin* in four volumes (1873–1882), he was appointed chief of the Division of Glacial Geology in the United States Geological Survey. From 1887 to 1892 he was president of the University of Wisconsin. From 1892 to 1919, when he retired, he was head of the department of geology in the University of Chicago and director of the university's Walker Museum. Chamberlin founded the *Journal of Geology* in 1893 and was editor in chief until 1922. Soon afterward he began to publish papers on the spiral-nebula or planetesimal hypothesis of the earth's origin. In 1916 he published *The Origin of the Earth*, one of many important studies, and his final work, *The Two Solar Families*, in 1928.

CHAMBERS, Edward Thomas Davies, Canadian journalist: b. Saffron Walden, Essex, England, June 26, 1852; d. Quebec, Canada, Oct. 5, 1931. Emigrating to Canada in 1870, he taught for a short time and then entered journalism, becoming editor in chief of the *Quebec Daily Chronicle* in 1897. In his later years he served in the Department of Colonization and Fisheries at Quebec. Among his publications were *The Port of Quebec: Its Facilities and Prospects* (1890); *Quebec, Ancient and Modern* (1892); *Chambers' Guide to Quebec* (1895); *The Onana-*

niche and its Canadian Environment (1896); *The Anglers' Guide to Eastern Canada* (1898); and *The Quebec Tercentenary Commemorative History* (1909).

CHAMBERS, Ephraim, English miscellaneous writer and encyclopedist: b. Kendal, Westmoreland, England, 1680; d. Islington, May 15, 1740. Upon leaving school he was apprenticed to a maker of globes and mathematical instruments in London. Through that association he acquired such a taste for the study of science and became so proficient in it that he not only conceived the idea of compiling his famous *Cyclopaedia*, or *an Universal Dictionary of Arts and Sciences*, but also wrote some of the articles. The first edition was published in 1728 in two volumes. Subsequent editions appeared in 1738, 1739, 1741, 1746. A French translation of the *Cyclopaedia* was the basis of the *Encyclopédie* compiled by Denis Diderot and Jean Le Rond d'Alembert in 35 volumes (1751–1780). Revised and enlarged editions were prepared by George L. Scott (1753) and in four volumes by Abraham Rees (1781–1786), who later used it as a basis for his *Cyclopaedia* (1819). Thus the *Cyclopaedia* was the source whence other famous works sprang.

CHAMBERS, Ernest John, Canadian writer and public servant: b. Penkridge, Staffordshire, England, April 16, 1862; d. Ottawa, Ontario, Canada, May 11, 1925. He settled in Canada at an early age, received his high school education in Montreal, entered journalism with the *Montreal Star*, and joined the militia. When the Indians of northwest Canada rebelled in 1865, he acted as a war correspondent. In 1893 he returned to Ottawa to edit the *Canada Military Gazette*. This brought him into official circles, and he served as gentleman usher of the black rod in the Canadian Parliament (1904–1925). Contact with parliamentarians, in turn, resulted in his editorship of the *Canadian Parliamentary Guide* (1908–1925). He maintained his interest in the militia and, when World War I began, he was appointed censor at Military Headquarters, Ottawa, and in 1915 chief press censor for Canada. Despite his numerous activities he wrote the histories of nine regiments. Two of his more important books are *The Royal North West Mounted Police* (1906) and *The Unexploited West* (1914), based on his travels throughout the Far West.

CHAMBERS, George, English marine painter: b. Whitby, Yorkshire, England, 1803; d. London, Oct. 28, 1840. His early life was spent at sea where his sketches showed so much promise that he was allowed to abandon his apprenticeship to study painting. While supporting himself as a house painter, his work attracted the attention of Thomas Horner, who engaged him to paint a panorama of London for the exhibition building in Regent's Park. Employing water colors as well as oils, he exhibited at the Royal Academy. Two of his marine pictures are in the Greenwich Naval Hospital: the *Bombardment of Algiers in 1816* and the *Capture of Portobello*.

CHAMBERS, Robert, Scottish publisher and author: b. Peebles, Scotland, July 10, 1802; d. St. Andrews, March 17, 1871. Largely self-educated and in poor circumstances, he moved with his family to Edinburgh in 1813. His interest in that city led to his writing *Traditions of Edin-*

burgh in two volumes (1823; new ed. 1868). He opened a bookseller's shop in 1816 and, prospering, began to publish his books on Scottish history and his collections of rhymes and ballads of Scotland. With his brother William (q.v.) he began publication of *Chambers's Journal*, whose success led to the founding of the publishing firm of W. & R. Chambers (1832). With Robert Carruthers he wrote a *Cyclopaedia of English Literature* in two volumes (1844). His greatest work was *Vestiges of the Natural History of Creation*, published anonymously, to avoid attack, in 1844; its true authorship was disclosed in 1884. Charles Darwin considered it a valuable preparation for his own work. After a visit to the United States in 1860, Chambers moved to London to collect material for his *Book of Days* (q.v.) in two volumes (1862-1864).

CHAMBERS, Robert William, American artist and author: b. Brooklyn, N. Y., May 26, 1865; d. New York, N. Y., Dec. 16, 1933. Beginning his career as an artist and illustrator, he wrote his first book on his life as a student in Paris, *In the Quarter* (1894), and thereafter made writing his lifework. A play, *The Witch of Ellengowan*, written for Ada Rehan, was performed in New York in 1897. His early novels were French historical romances, *The Red Republic* (1895) and *Lorraine* (1898). Then his knowledge of upper New York State, Sir William Johnson, and the Indians, produced his finest work, novels of the American Revolution, *Cardigan* (1901); *The Maid-at-Arms* (1902); and *The Reckoning* (1905).

An excellent naturalist and collector of butterflies, he lived during the summer months at Broadalbin, Fulton County, N. Y., where he wrote nature stories for children: *Outdoorland* (1902); *Orchard-Land* (1903); and others. He was known as a collector of Japanese and Chinese antiques. His most successful novels financially were the society novels. Among these were *The Fighting Chance* (1906); *The Danger Mark* (1909); and *The Common Law* (1913). A novel, *Iole*, a satire on the "new art" of his day, published in 1905, was made into a musical comedy in 1913. Later he returned to historical novels in *The Hidden Children* (1914); *Little Red Foot* (1921); and *The Sun Hawk* (1927). His short stories and serialized novels were published in magazines until his death.

CHAMBERS, Sir William, English architect: b. Stockholm, Sweden, 1726; d. London, England, March 8, 1796. Brought to England by his British parents in 1728, he lived at Ripon, Yorkshire, where he was educated. Visiting China as supercargo to the Swedish East India Company, he made many drawings of Chinese buildings and costumes, which were engraved and published in 1757. He traveled in Italy and France to study architecture and soon after his return in 1755 was appointed drawing master to the prince of Wales, afterward George III. His first important assignment was the villa for Lord Bessborough at Roehampton, in classical style. He designed the royal gardens at Kew in Chinese style, including the pagoda. One of the first members of the Royal Academy (established 1768), he exhibited many architectural drawings and designed many town houses in London, Dublin, and Edinburgh, as well as country mansions. He rebuilt Somerset House in London (1775),

one of his most successful works. His *Treatise of Civil Architecture* (1759) was a popular manual and had several editions.

CHAMBERS, William, Scottish bookseller and printer: b. Peebles, Scotland, April 16, 1800; d. Edinburgh, May 20, 1883. The elder brother of Robert Chambers (q.v.), he was the business expert of the firm of W. & R. Chambers. With Robert, he published *Chambers's Encyclopaedia* first issued in 520 weekly parts between 1859 and 1868. They employed Andrew Findlater as editor and adapted some material, by agreement, from the famous German *Konversations-Lexikon* published by F. A. Brockhaus. As a writer himself, he published *Things as They are in America* (1854); histories of Italy, France, and Scotland; books on animals, on slavery, and on various tours which he took. He is remembered for his gifts to Edinburgh in reconstructing parts of the old town, donating Chambers Institution, and restoring St. Giles' Church while he was lord provost.

CHAMBERS, in law, the office or private rooms of a judge. For the convenience of the parties to a lawsuit, a judge may hear matters and transact other business "at chambers" or "in chambers" when a hearing in open court is not required. Examples of chambers business are the signing of judgments and the taxing of costs. Such business may be conducted either in term (that is, when the court is in session) or in vacation. Chambers are not necessarily a specific room or location, for the term denotes any place where a judge's work out of court is performed.

CHAMBERS OF COMMERCE, organizations composed of business and professional men in practically every principal city in the Western World. In the United States, Canada, and Great Britain, the chamber of commerce is a voluntary organization, independent of the government, and organized for the improvement both of business in its community and of the community itself. In Continental Europe and in several South American countries, the chamber of commerce has some official connection with the government, is supported in whole or in part by the government, and has certain duties assigned to it, such as compiling business and trade statistics, licensing new businesses, drafting laws relating to business and industry, and acting in an advisory capacity on proposed legislation.

In the United States, the chamber of commerce is a democratic organization voicing its members' majority opinion, and by its bylaws prohibiting its officers and directors from perpetuating themselves in office. A chamber's program varies according to size, location, resources, and needs of its community, but in general includes: (1) betterment projects designed to improve such things as schools, housing, traffic control, parking facilities, playgrounds, parks, hospitals, and airport; (2) promotional projects designed to increase trade and to attract new industries and more tourists; (3) educational projects designed to build greater public interest in current economic and social issues and to create a better understanding of the American system and operation of free enterprise.

Besides local chambers of commerce in the United States, there are also regional chambers and state chambers. And to express the views of businessmen on national issues, the chambers of commerce collaborate through a national federation of commercial organizations.

and trade associations, the Chamber of Commerce of the United States, founded in 1912. The national chamber maintains headquarters at 1615 H Street, N.W., Washington, D.C.; and divisional offices in New York, N. Y.; Atlanta, Ga.; Chicago, Ill.; Minneapolis, Minn.; Dallas, Texas; and San Francisco, Calif. Affiliation with the national chamber is voluntary, not automatic. The younger businessmen of the country, between the ages of 21 and 35, have their own organization, the United States Junior Chamber of Commerce, founded in 1920, with headquarters at 21st and Main streets, Tulsa, Okla., and with chapters in many towns and cities. The junior chamber stresses "training in citizenship and in chamber of commerce work to promote civic, industrial, and educational activities."

Historically, the roots of the chamber of commerce go back to the merchants' guilds of the 12th century, when these were formed to protect and promote their members' interests. The first organization to be known as "chamber of commerce" was established by the civic council of Marseille, France, in 1599. Later chambers of commerce were organized in other French cities and proved so successful in dealing with commercial and trade problems, that in 1700 Louis XIV ordered every trading center in France to form a similar organization. In 1789, however, Louis XVI, believing that chambers of commerce and trade guilds had become overly powerful, ordered them to be suppressed. A few years later Napoleon, in an effort to stimulate trade, ordered their re-establishment. Meanwhile, chambers of commerce had been organized in England, Ireland, and Scotland. In 1768 a chamber of commerce was formed on the island of Jersey in the English Channel. In 1783 chambers were created in Dublin and Glasgow; in 1785, in Edinburgh and Leeds; and in 1881, in London.

The oldest chamber of commerce in the United States is the Chamber of Commerce of New York, 65 Liberty Street, New York, N. Y. It was founded by a group of 20 merchants in 1768, was granted a charter by King George III in 1770, and has been in continuous operation ever since. It is said to be the first commercial organization in the world created entirely independent of the government. The early chambers of commerce in the United States, like those in England and in Europe, were concerned solely with trade and commerce. During the latter part of the 19th century, the number of chambers in the United States increased rapidly, and the organizations embarked upon general community development and promotion work. The Cleveland, Ohio, Chamber of Commerce, organized in 1848, generally is recognized as perhaps the first modern chamber of commerce in the United States, in that it was formed as both a commercial development and as an organization to improve the community.

The Chamber of Commerce of the United States sponsors six summer institutes to train executives for chamber of commerce work, and to upgrade those already in the work. These institutes are held at Northwestern University, Evanston, Ill.; Yale University, New Haven, Conn.; Adolphus Hotel, Dallas, Texas; Montana State University, Missoula, Mont.; University of North Carolina, Chapel Hill, N. C.; and Stanford University, Palo Alto, Calif. It publishes *Nation's Business* (monthly); *Legislative Outlook* (biweekly); *Washington Report* (weekly); *Legislative Daily*; and *American Economic Security* (8 issues yearly).

The International Chamber of Commerce, organized in 1920, has its headquarters in Paris. The office of the United States Council of the international chamber is at 103 Park Avenue, New York, N. Y.

ART BROWN,

Chamber of Commerce of the United States of America.

CHAMBERSBURG, borough, Pennsylvania, and seat of Franklin County; altitude 620 feet, on the Conococheague and Falling creeks, and served by the Pennsylvania and Western Maryland railroads, an airport, two federal and three state highways, 50 miles west-southwest of Harrisburg. Blue limestone, freestone, and marble abound in the vicinity and there is a large trade in farm products. Industries include railway repair and reclamation shops and manufactures of men's and women's clothing, hosiery, tomato and apple products, steam presses, power transmission machinery, and paper towels. Caledonia Park, a 260-acre state forest, is 10 miles to the east.

Chambersburg is the seat of Wilson College (1869) and of Penn Hall Junior College (1927), both for girls. The beautiful Wilson College campus was landscaped by the essayist Donald G. Mitchell (Ik Marvel).

History.—Chambersburg was first settled in 1730 by Benjamin Chambers, an immigrant from Ireland, who built a stone fort here after James Braddock's defeat in 1755. The settlement, for many years called Falling Spring, was incorporated in 1803. President James Buchanan was born nearby and the cabin where he was born was moved to the city in 1925. John Brown planned his raid on Harper's Ferry while he lived in Chambersburg in 1859. Here Gen. Robert E. Lee gathered his forces for the Battle of Gettysburg in 1863. Next year, in Gen. Jubal A. Early's raid into Pennsylvania, Gen. John McCausland entered Chambersburg with Confederate cavalry on July 30, 1864, and demanded a tribute of \$100,000 gold. When the money was not paid, the place was set on fire. The borough owns and operates the waterworks and an electric light and power plant. Its government is by chief burgess and council. Pop. (1950) 17,212.

CHAMBERTIN, shān-bēr-tān', a superior red burgundy wine, named after the place where it is produced, in the Department of Côte d'Or, France.

CHAMBERY, shān-bā-rē, city, France, capital of the Department of Savoy, 54 miles east of Lyon, at the junction of two small rivers, near the Isère. It is an archbishop's see, and contains a 14th to 15th century cathedral, six hospitals, a castle, a college, a museum, and a public library. In its vicinity are excellent baths, much frequented in summer.

It has several distilleries and manufactures machinery, clothing, flour, leather goods, and vermouths. The town is a communications center on the Paris-Lyon-Mediterranean Railroad.

History.—Chambery was founded in the 10th century. During the Middle Ages it was under feudal lords until 1232, when it was ceded to Thomas, 1st count of Savoy, who built the castle where the rulers of the house of Savoy resided until the government was removed to Turin in 1560. The town was surrendered to the French Revolutionists in 1792 and became the capital of the Department of Mont Blanc. It was ceded in 1815 to Savoy, which retroceded it to France in 1860. It suffered some damage in World War II. Pop. (1946) 29,975.

CHAMBEZI, chām-bé'zī, a river of Africa, in Northern Rhodesia, rising in the highlands south of Lake Tanganyika. Its tributaries are large and form a considerable stream which flows

about 300 miles southwest to Lake Bangweulu, thence to emerge as the Luapula River.

CHAMBLISS, Charles Edward, American entomologist: b. Petersburg, Va., Aug. 20, 1871. Graduating from the University of Tennessee in 1892, he was instructor in zoology and entomology there from 1894 to 1900 and in the same period was entomologist of the Tennessee Agricultural Experiment Station. From 1900 to 1901 he was state entomologist of Tennessee, when he became associate professor of zoology and entomology at Clemson College, entomologist of the South Carolina Experiment Station during 1901-1907, and state entomologist there from 1907 to 1908. From 1908 to 1930 he was agronomist in charge of rice investigations for the United States Department of Agriculture, traveling in Puerto Rico, the Dominican Republic, and in Cuba. From 1930 to 1941 he was the department's official in charge of rice technology and botany. After 1941 he was a collaborator in the department.

CHAMBLY CANAL. See CANADIAN CANALS.

CHAMBONNIERES, shān-bō-nyār', **Jacques Champion de**, French composer, harpsichordist, and organist: b. 1602; d. Paris, France, about 1672. The son and grandson of two famous organists, Antoine and Jacques Champion, he became the founder of the French harpsichord school. In 1643, Anne of Austria, wife of Louis XIII, named him first harpsichordist of the court, where he continued into the reign of Louis XIV. Chambonnières instructed Louis Couperin, uncle of the more renowned François Couperin (both of whom wrote for the harpsichord), and others among his numerous following. He published *Pièces de clavecin* in two volumes (1670; new ed. 1926).

CHAMBORD, shān-bōr', **COMTE DE** and **DUC DE BORDEAUX** (**HENRI CHARLES FERDINAND MARIE DIEUDONNÉ D'ARTOIS**), Bourbon claimant to the French throne: b. Paris, France, Sept. 29, 1820; d. Frohsdorf, Austria, Aug. 24, 1883. Born after the assassination of his father, Prince Charles Ferdinand de Bourbon, duc de Berry, he became the last claimant of the elder branch of the French Bourbon dynasty when his grandfather, King Charles X, abdicated in his favor after the revolution of 1830. His uncle, Louis, duc d'Angoulême, the eldest son of the king, renounced his rights at the same time. The Legitimists named the baby Henri V of France.

With his title unrecognized by the people, who had enthroned Louis Philippe of the house of Orléans, he was compelled to leave the country, and lived successively in England, Germany, Italy, and Austria, keeping a sort of court and occasionally issuing manifestoes. In 1846 he married Archduchess Maria Theresa, eldest daughter of the duke of Modena, and in 1851 inherited the domain of Frohsdorf, near Vienna, where he subsequently lived and died without issue. While abstaining from violent attempts to seize the crown, he omitted no opportunity of urging his claims, especially after the defeat of Napoleon III at the Battle of Sedan in 1870; but his belief in the divine right of the Bourbons and his failure to recognize accomplished facts and modern tendencies, destroyed all chance of his succession.

CHAMBORD, village, Quebec, Canada, in Lake St. John County, on the southern shore of Lake St. John. Industries include dairying and lumbering. Pop. (1951) 1,029.

CHAMBORD, a castle, park, and village in central France about nine miles northeast of Blois, Department of Loir-et-Cher. The splendid Renaissance castle, or château, on the Cosson River, a branch of the Loire, stands in the middle of a park, enclosed by walls over 20 miles in circumference. Begun in 1519 by Francesco Primaticcio in the reign of Francis I, it has a central square building (the keep) with a tower at each corner and a grand interior staircase surmounted by a lantern tower. The huge main façade is flanked by four round towers and comprises a great rectangle of buildings entirely empty save for the apartments on the first floor of the keep, which were those of Louis XIV, under whom the castle was completed. A number of French architects, including Pierre Nepveu, were responsible for it.

After the reign of Henri II the court sometimes stayed at Chambord, and Louis XIV used it for notable receptions. King Stanislas I Leszczyński of Poland lived there from 1725 to 1733; in 1745 it was given by Louis XV to Marshal Hermann Maurice de Saxe, who died there in 1750; Napoleon I gave it to Marshal Louis Alexandre Berthier. In 1821 a company of Legitimists bought it for the duke of Bordeaux, who had just been born, and when in exile he took his title, comte de Chambord, from it. Bequeathed to the ducal family of Parma in 1883, it was bought by the state in 1932 and is open to the public.

CHAMBRE ARDENTE, shān'br ar-dant' (fiery chamber), an apartment hung with black and lighted with tapers, in which the corpse of a person of distinction is deposited before the funeral ceremonies. The name was formerly given in France to an apartment, similarly draped and lighted, in which sentence of death, frequently by burning, was pronounced on heinous offenders.

In a historical sense the term is more especially given to an extraordinary tribunal which, from 1535 to 1680 in France, directed persecutions against heretics and acted as a sort of inquisition. The members of the tribunal, who were named by the pope, ferreted out heretics, tried them, pronounced sentence, and saw it executed. A *chambre ardente* was employed by Louis XIV to investigate the numerous cases of poisoning which, after the proceedings against Marquise Marie de Brinvilliers in 1676, were brought before the public. Many persons of the highest rank, among others Duke Francis of Luxembourg and Princess Louise of Savoy, were examined before this court between 1679 and 1680. The last exercise of its powers was at the celebrated trial of Catherine La Voisin for sorcery in 1680.

CHAMBRE INTROUVABLE, ān'trōō-vā-bl (the chamber whose like is not to be found), the term applied to the French Chamber of Deputies which met after the second return of Louis XVIII (from October 1815 to September 1816) and which by its fantastic loyalty threatened to plunge France again into anarchy and commotion. Its dissolution met with universal rejoicing. The electoral law of 1817 prevented the return of a similar chamber.

CHAMELEON, ká-mě'lě-ün, a southern circumpolar constellation, bounded by Octans, Apus, Musca, Carina, Volans, and Mensa. It was introduced by Edmund Halley in 1679. It is inconspicuous and contains 16 naked-eye stars, of which only four attain the fourth magnitude.

CHAMELEON, ká-mě'lě-ün or ká-mě'l'yün, any of about 90 species of lizards of the family Chamaeleontidae, found throughout Africa (except the Sahara), in Spain, Arabia, and the Near East eastward into India. They are most closely related to the Agamidae, an entirely Old World family of lizards related to the American Iguanidae.

Unlike most lizards, the chameleons are not swift and scampering creatures which pursue their prey, but rather are imbued with a lethargy seen elsewhere only among the mammalian sloths. All but one are arboreal and creep slowly through the branches or, more frequently, sit quietly upon a twig, maintaining a firm hold with their parrot-like feet. These feet are characteristic of the Chamaeleontidae and are not matched elsewhere among the reptiles, for on the hand two digits are directed outward, three inward, and on the foot three digits are directed outward and two inward, thus forming a grasping organ.

Since the slowness of the chameleons prevents pursuit of insects (their normal prey), chameleons are dependent on the remarkable agility of their tongue. The tongue is exceedingly long, in some species longer than the body, and terminates in a blunt and sticky tip which serves precisely the function of flypaper. Normally, the tongue is contracted and tightly telescoped upon its spike-like internal skeleton and lodged in the throat; but when an insect is spotted within range, the chameleon shoots forth its tongue with great rapidity, catching its prey on the sticky tip, and then, more slowly, retracts the tongue to bring the food within the jaws.

The eyes of chameleons are scarcely less remarkable, but can be approached among some of the Agamidae. The upper and lower lids are nearly completely fused, leaving a pinhole aperture for vision. The eye may be rotated forward and back, upward and down, and each eye can be rotated independently of the other. Chameleons almost continuously roll the eyes in this disconnected fashion, which gives them a somewhat disquieting appearance.

Considering the number of truly unique features possessed by the chameleon, it is perhaps unfortunate that they are famed chiefly for their ability to change color (metachrosis), an ability matched among some other lizards and exceeded among many fishes. This change, which usually ranges from blackish through greenish to pale pinkish, is a response primarily to temperature (perhaps to light intensity as well), not to the color of the background, the lizard becoming darker at cooler temperatures. The old question of what a chameleon would do on plaid or polka dots can be resolved by determining the temperature of the plaid. The mechanism of color change involves expansion and contraction of the dark pigment corpuscles (melanophores) under the direct influence of the sympathetic nervous system.

The skull of chameleons is scarcely less remarkable than the tongue and the feet, principally in the arrangement of the bones of the snout; the premaxilla, which in other reptiles forms the anterior border of the upper jaw, has

been squeezed out of the jaw margin and has become involved chiefly in the architecture of the bony nostril; on the other hand, the nasal bone, in other reptiles forming most of the border of the nostril, in the chameleons does not meet the nostril at all. Most conspicuous of cranial features is the development in many of the species of bony horns, either on the snout or over the eyes, or both in combination, giving a vague, and quite spurious, resemblance to the ceratopsian dinosaurs.

The largest of the chameleons, the East African *Chamaeleo melleri*, reaches a length of slightly under two feet, from tip of snout to tip of tail, while some of the pigmy chameleons (genus *Brookesia*) are about four inches in length when fully grown. Some of the African chameleons bear the young alive, but most lay eggs. It has been established in at least one species that the female may store active sperm over a season to fertilize the next clutch of eggs, a phenomenon known in other reptiles. In some species there is questionable evidence that the female dies after depositing her clutch of eggs. The female of the common chameleon, *Chamaeleo chamaeleon*, buries her eggs in the ground after digging with her feet a hole of about six inches in depth; since a chameleon's feet are singularly ill-adapted for digging, the process may require several days.

The American anoles (genus *Anolis* and some related tropical American genera) are frequently called chameleons from their ability to change color from green to brown. These are the "chameleons" most often sold at pet shops and carnivals. One species, *A. carolinensis*, is native to the southeastern United States as well as to parts of the West Indies, while a second, *A. sagrei*, native to the West Indies, ranges into the southern tip of Florida. Over 100 related species are found in the West Indies, Central America, and South America.

The anoles are not closely related to the true chameleons, family Chamaeleontidae, but are members of the family Iguanidae, to which most of the diurnal North American lizards belong. The anoles do not have the peculiar feet, tongue, and skull seen in the true chameleons, and even their mechanism of color change is different, for there is no direct nervous control over the pigment corpuscles. Nevertheless, some of the tropical anoles have the skull prolonged into crests and helmetlike growths superficially like some of the true chameleons. The males have a fanlike fold of skin beneath the throat, distended during excitement by the action of the rodlike bones supporting the tongue; usually, this fan is brightly colored.

The anoles feed principally on insects, as do the chameleons, but the anoles capture their prey by pursuit. Anoles are egg-layers. The true chameleons are unable to regenerate the tail when that member is damaged; in all species of the genus *Chamaeleo* the tail is prehensile, but in the genus *Brookesia* it is not. In the anoles, on the other hand, the tail is never prehensile and is regenerated when damaged.

S. B. McDOWELL,

American Museum of Natural History.

CHAMELEON MINERAL, permanganate of potassium, so called because a solution of it changes from green, through a succession of colors, to a rich purple.

CHAMFORT, shān-fôr', Sébastien Roch Nicolas, French writer: b. near Clermont, Auvergne, France, April 6, 1741; d. Paris, April 13, 1794. An illegitimate child, he took the name of Chamfort for his writing, and lived, after he left the Collège des Grassins, where he had free schooling, mainly by his wit. Popular in Parisian society for his witty observations, he was patronized by the nobility and introduced at court. A tragedy played (1776) before King Louis XVI and Queen Marie Antoinette brought him a pension and he was made a member of the French Academy (1781).

A bohemian and a revolutionary at heart, Chamfort left the court (after 1786) because of an unfortunate love affair and went to live at the house of M. Joseph de Vaudreuil, where earlier he had come under the comte de Mirabeau's influence. When the French Revolution began, he was in the Jacobin party that stormed the Bastille and was secretary of the Jacobin Club. He originated a number of revolutionary epigrams, the most famous of which was the title for the Abbé Sieyès' pamphlet: "*Qu'est-ce que ce Tiers-Etat? Tout. Qu'a-t-il? Rien.*" (What is the Third Estate? Everything. What has it done? Nothing.)

Chamfort came into conflict with Jean Marat and Maximilien Robespierre after the downfall of the Girondins. Threatened with imprisonment, he tried to commit suicide and died later of his wounds. His best memorial is considered to be the collection of 1,800 bons mots published under the title *Chamfortiana*. His other works lack the sparkle of his conversation. His *Oeuvres complètes*, in five volumes, appeared in 1824-1825.

CHAMIER, shām'yēr, Frederick, English naval officer and novelist: b. London, England, 1796; d. Waltham Abbey, Essex, October 1870. The experiences for his novels were gained when he served in the British Navy from 1809 to 1833. He was a midshipman in the Mediterranean and saw active service with Sir Peter Parker on board the *Menelaus* during 1811-1814. After fights with French and Spanish ships, the *Menelaus* sailed to North America in 1814 to participate in the American War of 1812. Chamier then served in the Mediterranean and in the West Indies until 1826. He was retired in 1833 and was promoted captain in 1856.

On retirement Chamier turned to writing. Considered now as imitations of Capt. Frederick Marryat's, his novels were in his day very popular. Among them were *The Life of a Sailor* (1834); *Ben Brace* (1835); *The Arethusa* (1836); *Jack Adams* (1838); and *Tom Bowline* (1841). He also published *A Review of the French Revolution of 1848* (1849).

CHAMINADE, shā-mē-nād', Cécile Louise Stéphanie, French composer and pianist: b. Paris, France, Aug. 8, 1857; d. Monte Carlo, Monaco, April 18, 1944. A pupil of Benjamin L. P. Godard, she began composing when eight years old, and from the age of 18 appeared on the concert stage, frequently playing her own compositions on the piano. In 1908 she made a successful tour of the United States. Her best-known compositions include *Callirhoë*, a ballet symphony performed with great success at Marseille in 1888; *Les Amazones* for chorus and orchestra (1888); and a number of songs such as *Madrigal*, *Chanson Slave*, *Ritournelle*, *Fleur de*

Matin, and *Sans Amour*. She also wrote a concertstück for piano and orchestra, two piano trios, and many other works.

CHAMISSO, shā-mis'sō, Adelbert von, (originally LOUIS CHARLES ADÉLAÏDE DE CHAMISSO), German writer and naturalist: b. Châteaueu Boncourt, Champagne, France, Jan. 30, 1781; d. Berlin, Prussia, Aug. 21, 1838. At the outbreak of the French Revolution his family fled to Berlin, where Adelbert later served in the Prussian Army from 1798 to 1807. Returning to France, he was appointed professor in the lycée at Napoléonville, and for a time was one of the entourage of Mme. de Staël in Switzerland. He returned to Berlin to study natural science and was chosen a member of Otto von Kotzebue's scientific voyage around the world in the *Rurik*. Hoping to find the Northwest Passage, they made instead important discoveries in the North and South Pacific. Later he published *Remarks and Views on a Voyage of Discovery* (1819) and *Description of a Voyage Round the World* (1836). He presented the collections he made on the voyage to the museum of natural history in Berlin, where he was made superintendent of the botanic gardens and was given a doctorate.

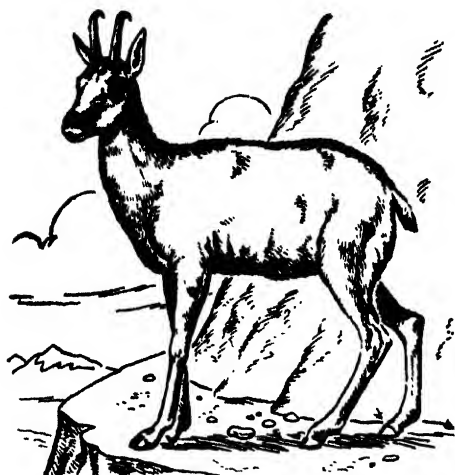
His reputation as a naturalist was overshadowed by his fame acquired as a poet. In 1814 appeared his most famous and original prose tale, *Peter Schlemihls Wunderbare Geschichte*, which has been translated, among other languages, into English, and illustrated by George Cruikshank. See WONDERFUL HISTORY OF PETER SCHLEMIHL, THE.

His poetry is marked by vigor, correctness, and a thorough command of the German language, but is, in general, of a gloomy cast, although he is the author of some humorous pieces. Many of his ballads and songs, some set to music by Robert Schumann, are masterpieces of their kind. His collected works have been edited most recently by Hermann Tarbel, *Chamisso's Werke*, 3 vols. (Leipzig 1907).

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CHAMOIS, shām'ī or shā-mwä', a horned ruminant hoofed mammal, *Rupicapra rupicapra*, one of the goat-antelopes, native to the mountains of middle and southern Europe, and southwestern Asia, ranging from Spain to the Caucasus and Asia Minor. It is about the size of a goat but more graceful, and its neck is somewhat longer in comparison. The general color is brown; the head pale, almost yellow, with a dark stripe on each cheek; the hoofs black. The short black horns rise straight from the forehead, recurve backward at the tip, and may reach a foot in length.

The chamois may be found in summer in the highest alpine altitudes, close to and sometimes beyond the snow line. In winter it seeks the forests, where it is somewhat more protected from its enemies. In the Alps, where it has been much hunted and may now be taken only in



Chamois.

season, the chamois is rare and the herds are smaller than in the Carpathians and farther east. The breeding season is in March; the young are born in May and June.

The chamois is famous for its agility; it is timid, and, when feeding in flocks, one is always on the watch to announce danger by a peculiar whistling noise.

Chamois leather is valuable commercially for its softness and warmth (see LEATHER—*Chamois*). Ordinary "chamois leather," however, is prepared from sheepskin or goatskin. The flesh of the chamois is considered a table delicacy and the horns are used for ornamental purposes, especially for making souvenirs of Alpine tourist resorts.

KARL F. KOOPMAN.

CHAMOMILE, kām'ô-mīl, or **CAMOMILE**, a low perennial plant. *Anthemis nobilis*, belonging to the family Compositae and best known for its use as a home remedy. It has prostrate spreading branches, downy, aromatic, deeply cut (twice pinnate) leaves, and daisylike flowers. Chamomile is native to Europe, but in the United States has escaped from gardens and is widely distributed. Sometimes called Roman or English chamomile to distinguish it from the German chamomile (a related plant *Matricaria chamomilla* of similar appearance and use), *Anthemis nobilis* is grown commercially in Europe for the flower heads, normally yellow, which are dried and used in making a tea. The infusion is popular as a tonic, carminative, emmenagogue, and for many other uses; the flowers have been applied externally in poultices for such pains as rheumatism, earache, and toothache; the oil is used for cosmetics and perfumery, and an infusion of the flowers is used as a hair rinse.

CHAMOND, Saint. See SAINT CHAMOND.

CHAMONIX, shâ-mô-nê', or **CHAMOUNI**, sh-â-môô-nê' (derived from Fr. *champs munis* or Lat. *campus munitus*, fortified grounds), a valley of southeastern France, in the Department of Haute-Savoie, in the Savoy Alps, fully 3,500 feet above sea level. The valley is about 14 miles long and 1-2½ miles wide, lying southwest and northeast, its east side formed by Mont Blanc and other lofty mountains of the same range, and its west side by Mont Brévent and the Aiguilles Rouges. It is traversed in its

whole extent by the Arve River, which leaves the valley by a narrow gorge at the southwest end, through which also passes, high above the river, the highway to Sallanches and Geneva. At its north end the valley communicates with the Swiss canton Valais by two roads and a bridle path, the latter crossing the Col de Balme. The mountains on the west side of the valley, though attaining an altitude of 8,500 feet, are not covered with snow in summer; but those on the east side, in the range of Mont Blanc, being from 10,000 to 15,000 feet high, are always snow clad, except where the peaks are too perpendicular for snow to lie. From the snowy range proceed glaciers, some approaching near the cultivated fields. The three most important are the Glacier d'Argentière, the Glacier des Bossons, and the Mer de Glace, the last being one of the largest in the Alps. From its lower extremity the meltings of the glacier flow, in greater or less volume according to the season of the year, from under a naturally formed ice arch, the source of the Arveyron, a small stream flowing into the Arve. The lower slopes of the mountains are timber covered. The soil is not very fertile, but it is assiduously cultivated, and the inhabitants grow barley, oats, spelt, flax, and potatoes, raise cattle, and keep bees. During the winter, yarns, cloths, hats, and implements are made, and many articles carved from wood.

Of the numerous villages in the valley (pop. 5,883 in 1946), Chamonix-Mont-Blanc is chief. About 37 miles southeast of Geneva, at an altitude of 3,402 feet, it is a year-round tourist center. The ascent of Mont Blanc is usually made from it. Pop. (1946) 2,654.

CHAMORROS, chā-môr'rôs, natives of the Mariana Islands and Guam (qq.v.), in the western Pacific. One of the Micronesian divisions of the Pacific islanders, the Chamorros are distinguished by their lighter skin, fine physique, and independent spirit. Attacked by the Spaniards in the 17th century, they fought bravely and their numbers were greatly reduced. Since then under successive foreign governments they have intermarried so widely that no more than about 3,500 of unmixed blood remain. Guam is an unincorporated territory of the United States and the adjoining islands are administered by the United States as a trust territory.

CHAMP CLOS, shân klô' (French, meaning a closed-in field or area), formerly a place set apart for duels for those who wished to settle in that manner a lawsuit or a dispute of honor. This name was also given to any place where tournaments were held.

CHAMP DE MARS, shân dē mâr's', in Paris, France, an extensive area on the left bank of the Seine, between the river and the École Militaire. Constructed about 1770 as the military school's exercise field and parade ground, it subsequently has been the scene of various public festivals and great gatherings of people. It is about 1,100 yards long and about 550 yards wide, with four rows of trees on each side. Louis XVI and his family took part here, in 1790, in the great Fête de la Fédération, in which the king swore to defend the new constitution; in June 1794 it was the scene of the Fête de l'Être Suprême. In 1815 Napoleon selected the Champ de Mars for the scene of a general assembly of the French

people, at which he placed before the representatives of the nation the articles of a supplementary constitution, called *l'Acte additionnel*, intended to establish the legality of his throne. It has also been the site of international exhibitions since 1867.

CHAMP DE MARS, shān dě mǎrs (Lat. *Campus Martius*), and **CHAMP DE MAI**, shān dě-mǎ, the annual public assembly of the Franks. They were held originally in March and called from the place of meeting Champs de Mars. In the 8th century they were transferred by Pepin the Short, the father of Charlemagne, to the month of May, and called the Champs de Mai. At the Champs de Mai, all questions relating to public affairs, such as war, peace, and the enactment of laws, were decided by the majority. Those assemblies were held irregularly under the Merovingians, but became more frequent and systematic under the first Carolingians. Pepin called together only the nobility and the clergy, but Charlemagne ordered that every count should bring with him 13 men from his jurisdiction to represent the people in the General Assembly. The first descendants of Hugh Capet departed from this usage, but Philip IV, who reigned from 1285 to 1314, restored the third estate by calling together delegates from the cities.

CHAMPAC, chūm'pāk, or **CHAMPAK**, an East Indian tree (*Michelia champaca*), of the natural order Magnoliaceae. It has large axillary flowers of a deep yellow color, and very fragrant, which are much celebrated in Hindu poetry. The tree is sacred to Krishna, and the women of India adorn their hair with its blossoms. The bark is aromatic and bitter.

CHAMPAGNE, chām-pān' (Fr. shān-pān'y'), an ancient province, France, now a region, which before the Revolution formed one of the 12 great military governments of the kingdom. The name Champagne, formerly Champaigne, is derived from the vast plains which occupy the territory. Champagne was bounded on the north by the duchy of Luxembourg and the bishopric of Liège; on the east by Lorraine; on the south by Burgundy; and on the west by Orléanais, Île-de-France, and Picardy. It forms at present the departments of the Marne, Haute-Marne, Aube, Ardennes, and part of those of the Yonne, the Aisne, Seine-et-Marne, and Meuse. The land is fertile, and produces the celebrated wine called after its name. In the Middle Ages it was a countship of which Troyes was the capital, and was united with France when Louis Hutin, count of Champagne, succeeded to the throne of France under the title of Louis X in 1314.

CHAMPAGNE, a French wine made chiefly in the Department of the Marne, in the former province of Champagne. It is commonly divided into river and mountain wines (*vins de la rivière de Marne*, and *vins de la montagne de Reims*), the former being for the most part white, the latter red. Not all of these wines are sparkling or frothing, though by the name "champagne" is generally understood such wine as has been subjected to an imperfect fermentation, and contains a quantity of carbonic acid gas generated during the insensible fermentation in the bottle, this gas

being disengaged on removing the pressure by which it was detained in solution. The briskest wines are not always the best; they are, of course, the most defective in true vinous quality, and the small portion of alcohol which they contain immediately escapes from the froth as it rises on the surface, carrying with it the aroma, and leaving the liquor that remains in the glass nearly vapid. Hence the still or the creaming or slightly sparkling Champagne wines (*vins cré-mants* or *demi-mousseux*) are more highly prized by connoisseurs and bring greater prices than the full-frothing wines (*vins grand-mousseux*). By icing these wines before they are used the tendency to effervesce is in some degree repressed, but when they are kept cool this precaution is unnecessary. In general, it may be observed that the vineyards on the banks of the Marne supply the choicest wines, and that the quality degenerates in proportion as they recede from the river. Among the white wines of Champagne the first rank is generally assigned to those of Sillery, the produce of the vineyards of Damery, Cumières, Hautvilliers, and Dizy. Of the Reims Mountain wines those of Verzy, Verzenay, Mailly, Chigny, and Bouzy are most esteemed, but the Clos Saint Thierry furnishes perhaps the finest red champagne. The soil of the principal vineyards throughout Champagne is composed of a loose marl resting on chalk and sometimes mixed with flints. For the manufacture of the white Champagne wines black grapes are now generally used. In making the red wines the grapes are trodden before they are introduced into the vat. Champagne, when well made, and placed in cool cellars, will retain its good qualities from 10 to 20 years. See also WINE AND WINE MAKING.

CHAMPAGNY, shān-pā-nyé', Jean Baptiste Nompere de, Duc de CADORE, French naval officer and statesman: b. Roanne, Aug. 4, 1705; d. Paris, July 3, 1834. He entered the Royal Marines in 1774 and was a member of the States-General, National and Constituent assemblies. From 1791 until 1800 he remained in private life, being appointed by Napoleon in the latter year counselor of state. He was also employed by Napoleon as ambassador to Vienna (1801-1804), and as minister of the interior (1804-1807) and of foreign affairs (1807-1811), and he negotiated the marriage with Marie Louise. After Napoleon's downfall he transferred his allegiance to the Bourbons, under whom he was restored to the Chamber of Peers (1819).

CHAMPAIGN, shām-pān', city, Illinois, in Champaign County, at an altitude of 743 feet, 138 miles south of Chicago, on the Illinois Central, the New York Central, the Illinois Terminal, and the Wabash railroads. It adjoins Urbana on the west and the campus of the University of Illinois is in both cities. It is in an agricultural area and has a soybean processing plant, hybrid corn plant, railroad shop, planing mill, and manufactures of bleachers, road machinery, trailers, concrete culverts, forgings, industrial machinery, gloves, school supplies, athletic goods, and deep freeze units. It was settled about 1855 and called West Urbana, and incorporated as a city in 1860. Pop. (1950) 39,397.

CHAMPAIGNE, or **CHAMPAGNE**, shān-pān'y', Philippe de, Belgian painter of the

Flemish school: b. Brussels, May 26, 1602; d. Paris, Aug. 12, 1674. He went to Paris at the age of 19, and worked on the decorations of the Luxembourg under Jean B. J. Duchesne. He was later appointed by Richelieu to adorn his palace and to paint murals for the dome of the Sorbonne. He was one of the first members and finally rector of the Academy of Painting. His coloring is excellent and his portraits possess great merit. His best pictures are at Vincennes and at Paris; among them are a portrait of himself, a portrait of Richelieu, *La Cène*, and *Les Religieuses*, all in the Louvre.

CHAMPE, chāmp, John, American soldier: b. Loudon County, Va., 1752; d. Virginia, c.1807. He was selected by request of Gen. George Washington to go to New York as a deserter and spy, and if possible to seize and bring off Benedict Arnold in time to save the life of John André. Sergeant Major Champe undertook the enterprise with courage, passed the American lines with difficulty, was hotly pursued by his comrades as a deserter, reached New York, underwent an examination before Sir Henry Clinton, and by him was consigned to General Arnold, who gave him in the British Army his former rank. He discovered the custom of Arnold to walk in his garden at a late hour every night, formed a plan with a comrade to seize and gag him there, and to take him between them as a drunken companion to a boat on the Hudson, whence arrangements were made for his transportation to the American headquarters. On the appointed night Arnold failed to appear in the garden, and Champe, after waiting for him until near morning, returned with deep chagrin to his position in the British Army. It proved that Arnold had the day before changed his quarters, preparatory to the embarkation of his troops for Virginia. There was nothing left for Champe but to embrace the first opportunity to escape to the American Army, which he did soon after landing in Virginia, and joined the troops under Gen. Nathanael Greene. Washington discharged him from further service, lest, falling into the hands of the enemy, he should be immediately put to death.

CHAMPEAUX, shān-pō', Guillaume de, French philosopher: b. Champeaux, c.1070; d. 1121. He was so called from the place of his birth. He studied at Paris under Anselme de Laon and Roscelin, and afterward himself opened a school there in which he had numerous pupils. The schools opened by de Laon and Champeaux are regarded by some as the origin of the University of Paris. Among the pupils of Champeaux were Robert de Bethune, one of the distinguished prelates of the age, and still more famous, Pierre Abélard. Jealous of the younger man's acumen he retired from his school in 1113 to the abbey of St. Victor. A few months later he was made bishop of Châlons-sur-Marne. He defended the doctrine of realism against the nominalism of Abélard; but it is only in the works of Abélard that any record of their contention remains. Champeaux has left a treatise on the origin of the soul, *De Origine Animae*, in which he examines the question wherein children dying without baptism are justly damned, which he concludes by referring to the unfathomable judgments of God. His other works include *De Eucharistia*; *De Generibus et Speciebus* (in-

cluded in V. Cousin's *Ouvrages inédits d'Abélard*, Paris 1836); and *Sententiae* (extracts printed in G. Lefèvre's *Les variations de G. de Champeaux*, Paris 1898).

He is considered the first prominent dialectician of the realist sect.

Consult Michaud, E., *G. de Champeaux et les écoles de Paris au XIII^e*, 2d ed. (Paris 1868).

CHAMPERICO, chām-pā-rē'kō, town, Guatemala, in Retalhuleu Department, situated on the Pacific Coast, 23 miles southwest of the city of Retalhuleu. It has a beautiful beach, and is popular with hunters and fishermen. Exports include coffee and sugar. Pop. (1950) 982.

CHAMPERTY, chām'pēr-tī, or **CHAMPARTY** (Lat. *campi partitio*, a division of lands), in law, a bargain with the plaintiff or defendant in any suit to have part of the land, debt, or other thing sued for, if the party that undertakes the suit prevails therein, the champertor carrying on the party's suit at his own expense. It is a species of maintenance, and is generally held to be illegal both in courts of common law and equity; but in some of the states of the United States such agreements are recognized by law, and the tendency is toward freedom of action in these as well as other contracts. See also MAINTENANCE.

CHAMPFLEURY, shān-flū-rē' (pseudo-nym of JULES FLEURY-HUSSON), French novelist and miscellaneous writer: b. Laon, Sept. 10, 1821; d. Paris, Dec. 5, 1889. His story of *Chien-Cailou* (1847) was in Victor Hugo's opinion a masterpiece of realistic description. He wrote an autobiographical account of his youthful years in *Confessions de Sylvius* (1849). But his *Les bourgeois de Molinchart* (1855), a satiric delineation of the provincial bourgeoisie, made him famous. He was a pronounced realist, his other works including *Les oies de Noël* (1853); *Les amoureux de Saint Péline* (1859); *Monsieur Tringle* (1866); *Fanny Minoret* (1882). He at one time owned a ceramic factory and wrote a book on design and ceramics, *Bibliographie céramique* (1881).

CHAMPIER, shān'pē-yē, Symphorien, French poet and historian: b. Saint Symphorien-sur-Coise, Rhône, 1472; d. Lyon c.1540. Famed as a physician, with powerful friends at court, and an ample fortune, he took delight in literature and the society of literary men, himself writing a series of poems entitled *Virtuous Ladies* (1503), containing four divisions dedicated to love. His best history is *Les gestes, ensemble de la vie du preux chevalier Bayard* (1525).

CHAMPIGNON, shām-pīn'yūn, the French name for the mushroom, and the term commonly applied to the mushroom *Marasmius oreades* in the United States.

CHAMPION, shām-pīn'yūn, one who undertakes to defend, in combat or by argument, another person, a doctrine or a cause. In the rudest state of society men avenge their own wrongs without restraint. The first step commonly made toward a better state of things in the rude beginnings of political society is to confine this right within certain bounds, and allow it to be exercised only with certain formalities. This

was done by the feudal institutions of Europe, which recognized in many circumstances, under the toleration of the church itself, the right of private combat, which became a common means of settling disputes. It was not always waged, however, by the contending parties and, in the cases of felony, or inability to fight because of age or sex, the question was left to a more rational mode of settlement. But in the writ of right, the last and most solemn decision respecting real property, the tenant was required to produce his champion, who threw down his glove as a challenge to the champion of the defendant; the latter, by taking it up, accepted the challenge. The law authorizing judicial combat, though fallen into disuse, was kept on the English statute book until 1819.

Even the right of the English crown was in some degree put in issue by appeal to judicial combat; and the appearance of a champion offering battle to anyone who would gainsay the right of the king to the crown was until recently a part of the ceremonial of the coronation. The champion's function was to ride into Westminster Hall in full armor, throw down his gauntlet and proclaim readiness to defend the title of the sovereign against anyone disputing it. After George IV's coronation, the champion lost this function and merely walked in the coronation procession bearing the standard of England (red flag with three gold lions). At the coronation of Elizabeth II in 1953 he bore the Union Standard (United Kingdom flag).

CHAMPIONNET, shān-pyô-ně', Jean Antoine Étienne, French soldier: b. Valence, France, 1762; d. Antibes, Jan. 9, 1800. Having entered the army at an early age, Championnet took part in the siege of Gibraltar (1780-1783). In 1793, as a brigade commander in the Rhine campaign, he distinguished himself at Weissenburg. In 1798 he was named commander in chief of the "Army of Rome" which was to protect the young Roman republic against Naples and its allies. Capturing Naples in January 1799, he set up the Parthenopean Republic (q.v.) there, but was arrested by the Directory's commissioner attached to his army. Acquitted unanimously at his trial, he became commander in chief of the "Army of the Alps," hardly more than a paper force. The defeat of Barthélemy C. Joubert's army at Novi by the Russians and Austrians (Aug. 15, 1799) forced him to retreat to Nice where he died of an epidemic that decimated his troops.

CHAMPION'S HILL, Battle of, fought on May 16, 1863 at Champion's Hill near Vicksburg, Miss., between the Union troops under Gen. Ulysses S. Grant and the Confederates under Gen. John C. Pemberton.

After the failure of several attempts to capture Vicksburg earlier in the war, General Grant decided to cut loose from his supply base at Memphis, Tenn. (March 29, 1863), crossed the Mississippi above Vicksburg, and marched through the swamps of the Louisiana shore down to a point where he could cross to Bruinsburg, Miss., 32 miles below Vicksburg (April 30). The Union Fleet, meanwhile, had run the Vicksburg batteries in the night of April 16 with supplies for Grant, and had assisted the troops in crossing the river.

On May 1, Grant marched to Port Gibson,

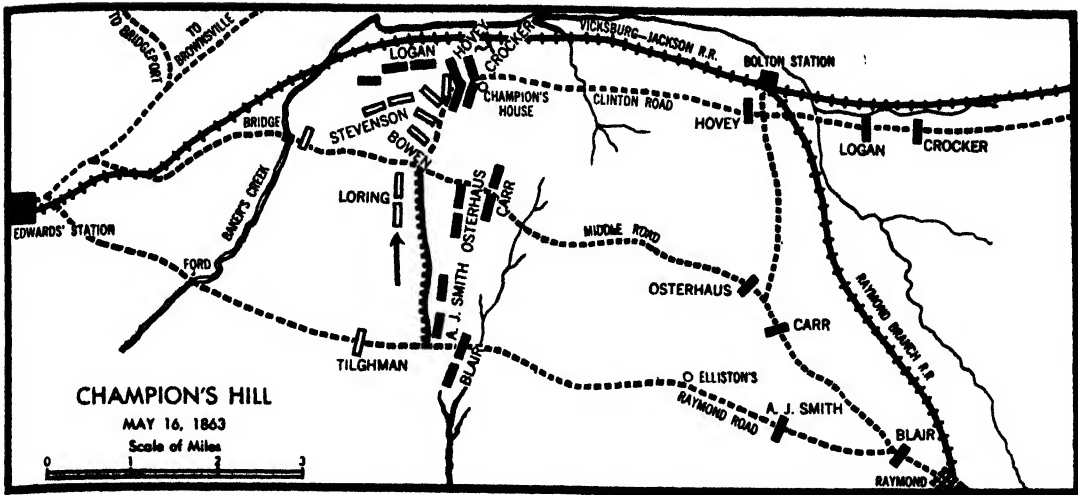
defeating Confederate troops under Gen. J. S. Bowen; then continued his march in a northeasterly direction and on May 12 encountered and defeated enemy forces at Raymond. The important railway junction of Jackson, Miss., was taken two days later and all supplies useful to the enemy were destroyed before Gen. Joseph E. Johnston could get there. The latter sent a dispatch to General Pemberton advising that the two armies should try to unite on the Jackson-Vicksburg railroad near Clinton. Grant, however, had intercepted this dispatch and decided at once to move toward Pemberton, while the latter, anxious to hold Vicksburg and the Big Black River line, questioned the wisdom of such a movement and hesitated to follow Johnston's advice. Upon the suggestion of Carter L. Stevenson and William W. Loring, Pemberton decided to move on Grant's rear in the direction of Raymond, and on May 15 advanced for that purpose.

Early on the next morning Pemberton received another dispatch from Johnston, urging him to move toward Clinton, where Johnston hoped to meet him with about 6,000 men. Pemberton immediately turned back his trains to Edward's Station to get the road leading northward to Brownsville, but had scarcely done so, when P. J. Osterhaus' and A. J. Smith's divisions of Grant's army made their appearance on the Raymond road and attacked his skirmishers, whereupon Pemberton suspended his movement to join Johnston. Continuing the rearward movement of his trains, he formed for battle with a force of about 17,500 men on the general line of a crossroad connecting the Raymond and Clinton roads.

The position of Grant's army on the night of May 15 was as follows: Alvin P. Hovey's division was at Bolton on the Clinton road; John A. Logan's and C. C. Crocker's were on the same road a few miles in Hovey's rear; Osterhaus' was on a crossroad, halfway from Raymond to right, covering the Raymond road, and Bowen in the center and Stevenson on the left on the northern point of a narrow ridge known as Bolton; Eugene A. Carr's was a short distance in Osterhaus' rear; and the divisions of Smith and Francis Preston Blair were west of Raymond on the Edward's Station road. These seven divisions numbered about 32,000 men on the three roads converging on Edward's Station, the Raymond road on the south, the Middle road, and the Clinton road on the north.

Early in the morning of May 16, Grant, at Clinton, hearing that Pemberton was marching to attack him, sent orders for James B. MacPherson, with the divisions of Logan and Crocker, to close up rapidly on Hovey, and for the four divisions under John A. McClernand on the Raymond and Middle roads to move forward cautiously. He then hastened by the Clinton road to the front. A. J. Smith, advancing on the Raymond road, attacked and drove in Loring's skirmishers about 8 A.M., and Osterhaus on the Middle road engaged those in his front. Artillery was brought up and opened fire; but McClernand, doubtful whether Grant wanted him to bring on a general engagement, deferred attack until 2 P.M., when he received Grant's order to attack. He then ordered Smith and Osterhaus to press for victory, but meanwhile the battle was being fought out and decided on Champion's Hill.

Advancing on the Clinton road, Hovey began



skirmishing with Stevenson about 10 A.M. and started to form line for a general attack, but was directed by Grant to wait until McClernand could be heard from. Logan came up at 11 A.M.; nothing had been heard from McClernand, so line was formed for a general attack, Hovey south of Clinton road with Logan on his right. About noon Hovey advanced with great spirit, charging up Champion's Hill. After a hard contest with varying success, he drove back Stevenson's right, capturing 11 guns. Logan, who had worked around on the north side of the hill, attacked and drove back Stevenson's left, and captured 7 guns. The positions thus gained were held until 2 P.M.

Meanwhile Stevenson, compelled to take ground to the left in order to meet Logan's flank movement and cover the road to Baker's Creek and Edward's Station, had induced Pemberton to draw Bowen to the left and close the interval between the two divisions, and Loring was ordered to close in on Bowen. It was after 2 P.M. when Bowen closed in on Stevenson and his two leading brigades. Francis M. Cockrell's and Green's, attacked Hovey furiously and drove him back down the hill. Hovey contesting every foot, but forced to abandon 9 of the captured guns.

As Hovey fell back, two brigades of Crocker's division came to his support and the Confederates were checked. Massed artillery now poured such an effective enfilading fire upon Stevenson's line that it was much shaken. Hovey and Crocker again charged up the hill, breaking the desperate resistance of Stevenson and Bowen.

Seeing his left defeated, Pemberton at 3 P.M. ordered a general retreat, Loring to cover it. Before this, Loring, leaving Gen. Lloyd Tilghman's brigade on the Raymond road to oppose Smith and Blair, had already with two brigades nearly closed up on Bowen. When the retreat began, he was forming his men between the Clinton and Raymond roads. Attacked by Osterhaus, he soon gave way, falling back to the Raymond road. Meanwhile Smith, advancing on the Raymond road, had defeated and killed Tilghman. Loring reunited his command and retreated on that road, but on approaching the ford of Baker's Creek he found it in Union possession. Realizing he had been cut off from Pemberton's army, he moved southward, abandoning his artillery, and on May 19 joined Johnston, who meanwhile had reoccupied Jackson. Stevenson's and Bowen's

men retreated to the Big Black, Grant following as far as Edward's Station, where darkness ended the pursuit. Continuing the pursuit next day, Grant defeated Pemberton at the Big Black Bridge, and on May 19 invested Vicksburg.

E. A. CARMAN.

CHAMPLAIN, shām-plān'; Fr. shān-plān', Samuel de, French explorer and colonizer: b. Brouage, Saintonge, France, about 1567; d. Quebec, Canada, Dec. 25, 1635. Champlain served in the army of Henry IV under Marshals Jean d'Aumont and Charles de Cossé, comte de Brisac, from 1593 to 1597. In January 1599, however, he entered the Spanish service, commanding a vessel that sailed to the West Indies, Mexico, and Panama. Back in France in 1601, he prepared a record of the cruise. This work, *Bref discours des choses plus remarquables que Samuel Champlain de Brouage a reconnues aux Indes Occidentales*, has been preserved in the library at Dieppe in manuscript form; an English translation appeared 1859.

Commissioned by Aymar de Clermont, seigneur de Chaste (Chastes), who was governor of Dieppe and held a royal patent for the fur trade and the colonization of the French territories in North America, Champlain set out for Canada in March 1603. There he explored the St. Lawrence River by boat, reaching Lachine Rapids below Lake St. Louis as the extreme point of his trip, and making friends with the Indians along the way. On his return to France, he published a book about his trip under the title *Des sauvages, ou voyage de Samuel Champlain de Brouage fait en la France Nouvelle*. De Chaste had died during Champlain's absence, and Pierre du Guast, sieur de Monts, had received the privileges for Canada.

In 1604, Champlain and de Monts coasted the shores of Nova Scotia, wintered on the island of St. Croix, and the next summer founded a colony at Port Royal (now Annapolis Royal). They spent the next two years making surveys and charts of the coast as far as Cape Cod. Meanwhile, the king, under pressure of Basque and Breton merchants, had withdrawn de Monts' privileges and opened the fur trade to the merchant marine. When de Monts and Champlain returned to France, however, they secured a restoration of the patent, with limitations.

Champlain subsequently sailed, for the third

time, to Canada, the main purpose of this trip being exploration for settlement. In 1608 he founded Quebec; owing to the rapid development of its fur trade, the settlement achieved an early prosperity. The following year, accompanying a war party of Algonquins and Hurons, he discovered Lake Champlain, and participated in a battle fought by his allies with the Iroquois. Stunned by the miraculous power of the white men's firearms, the Iroquois soon broke and fled in confusion. However, their bitter hatred for the French resulting from this battle was to become a severe handicap to the colony.

In the fall of 1609, Champlain returned to France to recruit colonists, a number of whom he brought to Canada in the following spring. In 1611 he founded, near Mount Royal, Place Royale, which was destined to become Montreal, and continued his expeditions covering a good deal of the country. Realizing that the future of the young colony depended to a great extent upon proper administration, he sought the protection of one of the great nobles with influence at court. After certain negotiations King Louis XIII, in 1612, appointed Louis de Bourbon, the comte de Soissons, lieutenant general of New France, and he in turn made Champlain his representative and commander at Quebec. After Soissons' sudden death, the post was given to Henry de Bourbon, prince de Condé, who retained Champlain's services.

In the following years Champlain continued his expeditions, fought with his Algonquin and Huron allies against the Iroquois, traversed a great part of what is now New York State, and eventually reached the north end of Lake Huron. During this period he made several brief visits to France. He fortified Quebec in 1620 and was made governor of New France in 1627. Two years later, however, he was obliged to surrender Quebec to an English fleet and was himself made prisoner. Brought to England, he was a captive until 1632. On his release he returned to Canada to resume his duties as governor. (See also CANADA—*Era of Early Discovery*.)

A complete edition of Champlain's works, edited by Abbé C. H. Laverdière, was published in 6 volumes in Quebec (1870). An English translation by C. P. Otis appeared in Boston in 3 volumes (1878-1882).

Consult Parkman, F., *Pioneers of France in the New World* (Boston 1865); Gravier, G., *Vie de Samuel Champlain* (Paris 1900); Dionne, N. E., *Samuel Champlain, fondateur de Québec*, 2 vols. (Québec 1891-1906); and Flenley, Ralph, *Samuel de Champlain, Founder of New France* (Toronto 1925).

CHAMPLAIN, Battle of Lake, in the War of 1812. Lake Champlain saw little military activity during the first two years of the war, both British and Americans being busy with construction of armed vessels. By mid-August of 1814, however, Sir George Prevost, governor in chief of the Canadas and commander in chief of British forces, with 11,000 men was ready to invade the United States and began his advance up the western side of the lake. At Plattsburg he faced an enemy force of approximately 1,500 American regulars and about 2,500 militia under Brig. Gen. Alexander Macomb. At the same time both fleets had been completed and were ready for battle. The British Fleet under Commodore George Downie followed the movement of the land troops; while the American ships under Master Commandant Thomas Macdonough

anchored inside the entrance of Plattsburg Bay.

Prevost's forces reached Plattsburg on Sept. 6, 1814, and for four days the two armies engaged in continuous skirmishing, Prevost not wanting to attack the strong fortifications, erected by Maj. Gen. George Izard and strengthened by Macomb, until he had the support of Downie's fleet. The latter arrived early on the morning of September 11, and at about 9 A.M. the two fleets became heavily engaged. Downie's force included the 37-gun *Confiance*, the *Linnet*, the *Chubb*, and the *Finch*, as well as 12 smaller vessels, while the American Fleet consisted of the 26-gun *Saratoga*, the *Eagle*, the *Ticonderoga*, the *Preble*, and 10 gunboats.

Macdonough had outmaneuvered Downie merely by the selection of an anchoring position which denied the enemy the advantage of their superiority in long-range guns, the British having 60, compared with 45 for the Americans. Before opening fire Downie was compelled to sail his ships 300 yards closer to his foe's than would have been necessary had the action been fought in the open lake with both fleets under sail. The decision was reached after the action had continued for an hour and a half, both sides suffering severely. Macdonough then wound his flagship, the *Saratoga*, and brought to bear on the *Confiance* an uninjured broadside. Too damaged to attempt a similar maneuver, Downie's flagship was forced to surrender; his other three large vessels then struck their colors and the galleys took to flight.

The casualties on the American side were 52 killed and 58 wounded, while the British lost 57 killed and 92 wounded. Early in the fight the *Eagle* and the *Preble* were forced out of action. Macdonough's victory was decisive, forcing Governor Prevost's army to retreat to Canada and forestalling any claim by the British government for territorial adjustments in the Lake Champlain area at the Treaty of Ghent (1814). Macdonough received many honors for his victory, including the thanks of Congress and promotion to a captaincy, the commission to date from September 11.

Consult Mahan, Alfred T., *Sea Power in Its Relation to the War of 1812*, 2 vols. (London 1905); Clark, George R., and others, *A Short History of the United States Navy* (Philadelphia 1911).

CHAMPLAIN, Lake, a body of water lying within the states of New York and Vermont and the Province of Quebec, Canada. It forms part of the boundary of the two American states, and about six miles of its northern end extends into Canada. Its extreme length from south to north is about 125 miles and it is from 400 yards to 14 miles wide; its greatest depth reaches about 600 feet. Scattered over the whole area of about 600 square miles are more than 50 islands; the altitude of the lake is 90 feet. It is bordered by the Green Mountains on the east, by the Adirondacks on the west; its waters are carried northward by the Richelieu River to the St. Lawrence. The Chambly Canal and the New York State Barge Canal System connecting with the lake enable barges and small yachts to voyage between New York City and Montreal. The chief cities on the lake are Burlington, Vt., and Plattsburg, N. Y. The only highway bridge over the lake, which connects Crown Point, N. Y., with Chimney Point, Vt., was opened in 1929.

Lake Champlain was discovered in 1609 by the French explorer Samuel de Champlain. It was

the scene of many battles from early colonial times, having been one of the main invasion routes between Canada and the English colonies that became the United States.

CHAMPLAIN STAGE, the name given by American geologists to the subsidence that was a feature of the close of the Glacial epoch in New York, New England, Ontario and Quebec. At the beginning of the Glacial epoch the elevation of this section of the continent may have been greater than now, but when the ice-sheet finally retreated the sea extended up the Saint Lawrence River nearly to Lake Ontario, and the lower Ottawa River and Lake Champlain were occupied by salt water. The stage is named from the lines of old sea beaches containing whale and walrus bones, thus showing the submergence, typically developed about Lake Champlain. The total amount of the depression varied, being greatest over the Saint Lawrence Valley. About New York Harbor the coast was depressed fully 70 feet; at Albany 355 feet. Along the Maine shore the land was 150 to nearly 300 feet lower than now, and in the Saint Lawrence Valley the depression was over 500 feet, making allowance for the previous elevation the total depression in the Saint Lawrence Valley reached 1,500 feet. The climate of Champlain time was probably warmer and moister than that of the present. On the Pacific coast are evidences of depression in the region about Mount Saint Elias, shells of Champlain species being found at an altitude of 5,000 feet. (See also GLACIAL PERIOD; QUATERNARY). The term Champlainic system was proposed to replace Ordovician system, but the proposal did not meet with general acceptance.

CHAMPLEVE, shān-lē-vā', **ENAMELS**. See ART ENAMELS.

CHAMPLIN, John Denison, American author: b. Stonington, Conn., Jan. 29, 1834; d. Jan. 8, 1915. He was graduated at Yale in 1856, and admitted to the bar in 1859. In 1864 he became associate editor of the *Standard* at Bridgeport, Conn. He afterward published *The Sentinel* (1865-1869) at Litchfield, Conn. He devoted himself entirely to literature from 1869, and became associate editor of the *American Encyclopaedia* (1875). Author *Young Folks' Cyclopaedia of Common Things* (1879); *Young Folks' Catechism of Common Things* (1880, 1906); *Young Folks' Cyclopaedia of Poems and Places* (1880, 1899, 1911); *Young Folks' Astronomy* (1881); *Young Folks' History of War for the Union* (1881); *The Chronicle of the Coach* (1886); *Young Folks' Cyclopaedia of Games and Sports* (with Arthur E. Bostwick, 1890); *Young Folks' Cyclopaedia of Literature and Art* (1901); *Young Folks' Cyclopaedia of Natural History* (1905); *The Tragedy of Anne Hutchinson* (1911). Editor *Fox's Mission to Russia* (1873); *Cyclopaedia of Painters and Paintings* (1886-1888); *Cyclopaedia of Music and Musicians* (1888-1890); *Liber Scriptorum* (1893). Associate editor *The American Cyclopaedia* (1873-1877); *The Standard Dictionary* (1892-1894); *Orations, Addresses, and Speeches of Chauncey M. Depew* (1910).

CHAMPNEY, chāmp'nī, Benjamin, American artist: b. Ipswich, N. H., Nov. 29, 1817;

d. Woburn, Mass., Dec. 14, 1907. He went to Boston in 1834, and for three years worked in a lithographic establishment. From 1841 to 1848 he studied painting in Paris and Italy, exhibiting several times in the Paris Salon. He worked chiefly in landscape and flower painting, and his White Mountain paintings, which are owned in and around Boston, are famous. Published *Sixty Years' Memories of Art and Artists* (1900).

CHAMPNEY, Elizabeth Williams, American author: b. Springfield, Ohio, Feb. 6, 1850; d. Oct. 13, 1922. She was graduated at Vassar College 1869, traveled extensively in Europe and wrote many papers for *Harper's* and the *Century*. She was president of the board of managers of the Messiah Home for Children. She published *The Bubbling Teapot*; *Howling Wolf and His Trick Pony*; *All Around a Palette*; *Bourbon Lilies*; *Rosemary and Rue*; *In the Sky Garden*; *Vassar Girls Abroad*; *Witch Winnie* series (7 vols.); *Dames and Daughters of Colonial Days*; *Romance of the Feudal Châteaux* (1900); *Romance of the Renaissance Châteaux* (1901); *Romance of the Bourbon Châteaux* (1903); *Romance of the French Abbays* (1905); *Romance of Italian Villas* (1906); *Romance of Roman Villas* (1908); *Romance of Imperial Rome* (1910); *Romance of Old Belgium* (1915).

CHAMPNEYS, champ'nēz, Basil, English architect: b. 1842; d. April 5, 1935. He was educated at Trinity College, Cambridge, and after studying architecture with the architect Prichard, of Llandaff, began the practice of his profession in 1867. Important works of his are the divinity and literary schools of Newnham College and the Archaeological Museum at Cambridge; Indian Institute, Robinson Tower at New College and Mansfield College at Oxford; Rylands Library in Manchester; Butler Museum at Harrow; and Quincentenary buildings at Winchester College. He was cathedral architect at Manchester. He published *A Quiet Corner of England*, a delightful description of Rye and Winchelsea; *Henry Merritt: Art Criticism and Romance*; *Coventry Patmore: Memoirs and Correspondence*.

CHAMPOLLION, shān-pō-lyōn', Jean François, French Egyptologist: b. Figeac, Lot, France, Dec. 23, 1790; d. Paris, March 4, 1832. At an early age he devoted himself to the study of Hebrew, Arabic, and Coptic. In 1807 he read a paper before the Academy of Grenoble on the ancient Egyptian geographical names, which he endeavored to explain by the Coptic. He then went to Paris, where he continued his Oriental studies, paying particular attention to the Coptic, and endeavoring through it to find the key to the Egyptian hieroglyphics. In 1809 he became professor of history at Grenoble, but soon retired from this post and went to Paris, where he devoted himself almost exclusively to the study of Egyptian antiquities. Assisted by the trilingual inscription of the Rosetta stone he at length discovered the key to the graphic system of the Egyptians, the three elements of which—figurative, ideographic, and alphabetic—he expounded before the Institute of France in a series of memoirs in 1823. These were published in 1824 at the expense of the state, under the title of *Précis du système hiéroglyphique des Anciens Égyptiens*. In 1824 he went to Italy, and investigated the collections of papyri and other Egyptian antiqui-

ties in the principal cities there. In 1826 Charles X appointed him to superintend the new department of Egyptian antiquities in the museum of the Louvre. In 1828 M. Champollion went as director of a scientific expedition to Egypt, at the expense of the king. He was admitted a member of the Academy of Inscriptions in 1830. In 1831 the chair of Egyptian archaeology was created for him in the Collège de France. His principal works are *Grammaire Égyptienne* and *Dictionnaire hiéroglyphique*, both published after his death.

CHAMPOLLION FIGEAC, fē-zhàk, Jean Jacques, French archaeologist, elder brother of the preceding: b. Figeac, Lot, Oct. 5, 1778; d. May 9, 1867. He completed his studies at Grenoble, published his first archaeological memoirs in 1803, and was named successively librarian of Grenoble, professor of Greek literature, secretary and dean of the faculty of letters of the same town. He took an active part in everything connected with science and letters in the department of the Isère. He acted as secretary to Napoleon in drawing up under his instruction the account of his memorable passage from Elba to Grenoble. In 1828 a place was made for him as keeper of the manuscripts in the Royal Library, and shortly afterward he was installed in the chair of Palaeography in the École des Chartes. He was made an officer of the Legion of Honor in 1866. His principal works are *Antiquités de Grenoble* (1807); *Annales des Lagides* (1819); *L'Égypte Ancienne et moderne* (1850); besides several other interesting works on Oriental history.

CHAMPS ELYSEES, shānz'ā'lē'zā' (Fr. "Elysian Fields"), an avenue in Paris, with its surrounding gardens. It extends from the Place de la Concorde to the Arc de Triomphe de l'Etoile, a distance of one and a quarter miles, and is a famous public resort and promenade. The lower end forms a park, on either side of which are placed the Palais de l'Elysée and the two Palais des Beaux Arts, occupying the site of the old Palais de l'Industrie. It became the property of the Crown in 1616 and was ceded to the city in 1828.

CHAN CHAN or **GRAN CHIMU**, former capital of the Chimus, about two miles from Trujillo, Peru. The origin of the Chimus is unknown, but the ruins of their capital, well preserved by a dry climate, show that their civilization was highly developed, and irrigation widely practiced in this quasi desert region. The city, built entirely of adobe bricks, covers some eleven square miles and probably housed upwards of 250,000 people. Centuries of constant warfare between the Andean Incas and the coastal peoples culminated in the capture by the Incas of Paramonga, the Chimu fortress near present-day Supe, about 1400 A.D., after which Chan Chan was taken and abandoned, the population being exterminated or redistributed in other parts of their empire.

CHANCA, chān'ka, Dr. (believed to have been DIEGO ALVAREZ CHANCA), Spanish physician: b. Seville; who became a companion of Columbus on his second voyage in 1493. One of the principal authorities for this voyage is the letter which he wrote to the Catholic college at Seville, giving an account of his journey. No

record has been kept of his subsequent life.

CHANCE, in its original and strict meaning, is a description of events which cannot be subsumed under any law, causal or theological. Strictly speaking, it is an idea which few men would now be disposed to admit as corresponding to anything which really exists; the religious mind excluding it as inconsistent with the belief in the divine government, and the philosophical mind rejecting it as inconsistent with a recognition of universal laws of causation. As a word, however, it has always been, and always will be, popularly accepted as a term denoting an unknown cause. For the mathematical theory of events which are chance in this derived sense, see **PROBABILITY**, **THEORY OF**.

CHANCE, a novel by Joseph Conrad (Teodor Josef Konrad Korzeniowski) (q.v.), published in 1913.

One of Conrad's longer and more elaborately constructed novels, it is in accordance with his own published statement, the life story of Flora de Barral, as seen through the eyes of several persons, including the author's faithful and articulate *alter ego* and narrator, the ubiquitous Marlow. It is also the story of Captain Roderick Anthony, whose dream it is to embrace a "wisp of mist," as he very romantically characterizes the slim, dark, pale, unhappy, and insubstantial Flora, whom he marries and takes to sea with him as a wife in name only, for the better part of two leisurely merchant voyages under sail and under circumstances of ever increasing tension. The resolution, handled with much skill and with a directness absent from the greater part of the tale, renders the twain one flesh and eliminates by suicide Flora's father, whose term of imprisonment for alleged financial irregularities on the grand scale, has for so long cast a deep shadow over his daughter's life.

Captain Anthony's sister, Mrs. Fyne, and his Second Mate aboard ship, young Charles Powell, are, in addition to Marlow, important to the reader's full understanding of the principal characters.

By more than one critic, *Chance* has been considered somewhat too long for its material and there can be no doubt that the narrative method is complicated, particularly in the early chapters. The climax, however, coming after so thorough a preparation, is probably the stronger for it, and there are in the book a number of instances of the true Conrad literary power which, at its best, is remarkable for its immunity from the withering touch of time.

CHANCE ACQUAINTANCE, A, a story by William Dean Howells, published in 1873. This agreeable and entertaining sketch contains many charming descriptions of the picturesque scenery and places about Quebec.

CHANCEL, that portion of a church occupied by the clergy, and often separated from the nave and aisles by screens of carved stone or oak. The screen separating the chancel from the nave is called the rood screen, because anciently a rood or large crucifix was usually placed on it, accompanied with two figures representing Saint John and the Virgin Mary. In the chancel were situated the high altar, the sedilia, or seats for the officiating clergy, and the piscina, in which the water used for washing

the hands of the celebrant was poured. It usually contains carved seats or stalls, occupied by the clergy not engaged in the services. These are enriched with carvings and have canopies of carved oak. The chancel occupies the same place with the apsis in the ancient basilicas, and was called so from the *cancelli*, or rails used in the early churches to separate the clergy from the laity. The chancel is always at the east end of the church (churches being technically considered as having their major axes extending east and west) and is often constructionally a separate building opening from the nave with a lower roof elevation and raised several steps above the nave.

In architecture the term is employed as denoting the space for clergy and choir, separated by a screen from the body of the church.

CHANCELLOR, Charles Williams, American physician: b. Spottsylvania County, Va., Feb. 19, 1831; d. Washington, D.C., Jan. 3, 1915. He studied at Georgetown College, 1848, and at the University of Virginia, 1851; was graduated from Jefferson Medical College, Philadelphia, 1853. During the Civil War he was medical director of Gen. George Edward Pickett's division of the Confederate Army, 1863-1865. He was professor of surgery in, and dean of, Washington University, Baltimore, 1868-1875; secretary of the Maryland State Board of Health, 1875; president of the Maryland State Insane Asylum, 1880; and United States consul at Le Havre, France, 1893-1897.

Among his numerous reports and articles on medical and sanitary topics are *Report upon the condition of the Prisons, Reformatories and Charitable Institutions of Maryland* (1875); *Contagious and Infectious Diseases* (1878); *Mineral Waters and Seaside Resorts* (1883); *Drainage of the Marshlands of Maryland* (1884); *Heredity* (1886); and *Sewerage of cities* (1886).

CHANCELLOR, Richard, English navigator; d. at sea, Nov. 10, 1556. Brought up in the household of the father of Sir Philip Sidney, who regarded him highly, he was chosen, in 1553, as captain of the *Edward Bonaventure* and "pilot-general" of Sir Hugh Willoughby's expedition in search of a northeast passage to India. The ships were parted in a storm off the Lofoten Islands and Chancellor, after waiting seven days at Vardoehuus, the rendezvous agreed upon, proceeded alone into the White Sea and traveled thence overland to the court at Moscow, where he was very hospitably treated, and was able to conclude a treaty giving freedom of trade to English ships. His interesting account of Russia was published in Richard Hakluyt's *Principal Navigations, Voyages, and Discoveries of the English Nation* (1589). The next spring Chancellor rejoined his ship and returned to England, where his hopeful reports led to the establishment soon after of the Muscovy Company. In the summer of 1555 he made a second voyage in the *Edward Bonaventure* to the White Sea, and was at Moscow once more in the succeeding winter. In July 1556, he set sail on his voyage homeward, but was lost in the wreck of his ship in Aberdour Bay off the Aberdeenshire coast.

CHANCELLOR, an officer supposed to

have been originally a notary or scribe, under the Roman emperors and named *cancellarius*, because he sat behind a lattice—called in Latin *cancelli*—to avoid being crowded by the people. There are, however, other derivations of this title. Whatever may have been its origin, the office and name of chancellor were undoubtedly known at the court of the Roman emperors, where the title seems to have signified originally a chief scribe or secretary, who was afterward invested with several judicial powers and with superintendence over the other officers of the empire. From the Roman Empire the title and office passed to the Roman Catholic Church and hence every bishop has to this day his chancellor, the principal judge of his consistory. When the modern kingdoms of Europe were established upon the ruins of the empire, almost every state preserved its chancellor, with different jurisdictions and dignities according to their different constitutions. In all he seems to have had the supervision of all charters, letters, and such other public instruments of the crown as were authenticated in the most solemn manner, and therefore, when seals came into use, he had always the custody of the king's great seal. This officer has now great authority in all the countries of Europe.

Great Britain.—Lord High Chancellor of Great Britain (originally of England).—He is the first judicial officer of the crown and exercises an extensive authority as head of the judiciary. He ranks as first lay person of the state after the blood royal. He is always one of the commissioners appointed to represent the sovereign in opening and closing Parliament or giving the royal assent to bills. He is created by the delivery of the great seal into his custody. In like manner the act of taking away the seal formally terminates his office. He is a Cabinet Minister and a privy councillor in virtue of his office, is speaker of the House of Lords by prescription and in that office has the right to address their lordships as well as to vote. He vacates office with the ministry which appoints him. He has a salary of £10,000 and, no matter how brief his tenure of the office may be, is entitled to a pension of £5,000 a year on vacating it. When Sir Robert Finlay was nominated in December 1916 for the office in the Lloyd George government, he is believed to have created a precedent in stipulating waiver of the pension in his case. The lord chancellor presides over the Court of Appeal and the privy council in the exercise of judicial functions. He has the appointment of all justices of the peace in the kingdom, is visitor, in the king's right, of all royal foundations and patron of all crown livings, the higher dignities in the Church of England being nominated by the prime minister. The office having in early times been always filled by ecclesiastics (for no others were then capable of an employment requiring so much writing), he became keeper of the king's conscience; and by special appointment he now exercises a general superintendence as guardian over all infants, idiots, and lunatics, though these latter powers are not necessarily attendant on his office, as Sir William Blackstone seems to have imagined, but can be delegated by the crown to any other judicial officer. In fact, they were so delegated even as late as the reign of James I when the seals were held by Dr. John Williams, then dean of Westminster, and afterward bishop of Lincoln. Not infrequently the

great seal has been put in commission, and was last so on the resignation of Edward, 1st baron Thurlow, in 1793. One vice chancellor was appointed to preside in the courts of equity by 53 George III, c. 24, and two by 5 Vict. c. 5, § 19. The two last-mentioned were at first subordinate vice chancellors, but afterward they were all made of equal rank. They sat in separate courts, and an appeal lay from their decisions to the lord chancellor. They latterly sat in the chancery division of the Supreme Court of Judicature. See CHANCERY; SUPREME COURT OF JUDICATURE.

Chancellor of the Exchequer is the finance minister of the Cabinet and as all questions of supply originate in the House of Commons, a peer is ineligible for this office, which originated in the separation of the chancery from the exchequer in the reign of Henry III. The holder of this office in recent years is generally held as having the reversion to the premiership, with which it has occasionally been conjoined.

Chancellor of the Duchy of Lancaster is the representative of the crown in the management of the lands of the duchy, which are the personal property of the sovereign. The office is a sinecure and is usually held by a minister of Cabinet rank, of high standing in the country, but who is unable to bear the physical strain incident to the management of a heavy department.

Chancellor of the Order of the Garter and Other Military Orders, an officer who seals the commissions and the mandates of the chapter and assembly of the knights of the order, keeps the register of their proceedings and delivers their acts under the seal of their order. The title chancellor is given, in England, to several officers of other bodies.

Chancellors of Ireland and Scotland.—There was formerly a lord high chancellor of Ireland who was the head of the judicial bench, with a salary of £8,000. His office was abolished under the Free State Constitution. The chancellorship of Scotland was abolished at the union. The Scottish chancellor had no independent jurisdiction in equity, as there has never been a separate court of equity in Scotland; but he presided in Parliament, and was head of all the courts of judicature and of the Scottish office of chancery, in which all charters and other writs appointed to pass the great seal were recorded.

Chancellors of Other European Countries.—The chancellor was one of the highest officers in the German states and by the influence of his office was one of the most important. In Germany this dignity was from the remotest times vested in one of the higher clergy, until the head of the German clergy, the archbishop and elector of Mainz, united it permanently with his office as archchancellor of the empire. The two other spiritual electors held the same dignity, but it was merely titular; the archbishop of Cologne, as archchancellor of Italy; the archbishop of Trèves, as archchancellor of Gaul and Arles, that is, the kingdom of Burgundy, once belonging to Germany. The archchancellorship of Mainz, on the contrary, had important duties attached to it—the direction of the Diet and of the public business, as well as of all imperial chanceries. The elector appointed a vice chancellor, who was the actual minister of the empire at the imperial court. In the German Empire (1871–1918) the chancellor (*Reichskanzler*) was the president of the Federal Council (*Bundesrat*), and had the general conduct of the imperial ad-

ministration. All laws of the empire, after being sanctioned by the emperor, had to be countersigned when promulgated by the chancellor.

The chancellor of France held a position analogous to that in England, was the highest officer of state, and the only one who, when once appointed, could not be dismissed. In case, therefore, it was desired to remove him from participation in affairs, a keeper of the seals (*garde des sceaux*) was appointed. As the chancellor was properly the minister of justice, he was chosen from the body of jurists. A relic of his spiritual character was that all his furniture, liveries, and even his coach, were black.

Universities.—The *Chancellor of a University* is an official at the head of the university, generally a man of rank, whose duties are more or less nominal, but who is regarded as conferring the degrees. At Oxford his duties are almost entirely discharged by the vice chancellor, the chancellor's own acts being limited to the signing of diplomas. Under the vice chancellor are four pro-vice chancellors, nominated by him from among the heads of colleges, to one of whom, in his absence from the university, he delegates his authority. The chancellor of Cambridge University, whose duties are very similar to those of the Oxford official, is elected biennially by the senate, but there is no instance, at least in modern times, where a re-election has not taken place.

CHANCELLORSVILLE, The Battle of. The Chancellorsville campaign included the Battle of Chancellorsville, May 1–3, 1863, the action at Marye's Heights, May 3, 1863, and the engagement at Salem Church, May 3–4, 1863. In the fore part of April the Army of the Potomac, under Gen. Joseph Hooker, and the Army of Northern Virginia, Gen. Robert E. Lee commanding, confronted each other on opposite sides of the Rappahannock at Fredericksburg. Lee was so strongly entrenched on the south side of the river from Port Royal on the right to Banks' Ford on the left, a distance of 25 miles, that an attack on his front was impossible. Hooker decided to march his cavalry around Lee's left, destroy his communications with Richmond, compel him to evacuate Fredericksburg, at which time he proposed to fall on his flank and rear as he fell back. Gen. George Stoneman was ordered, on April 13, to ascend the Rappahannock with his 10,000 cavalry, cross it west of the Orange and Alexandria Railroad, attack Lee's cavalry wherever met, and cut off his line of retreat. Hooker was obliged to modify his plans when Stoneman found the streams impassable because of the heavy rains. He determined to force Lee to come out and fight on open ground of Hooker's own choosing.

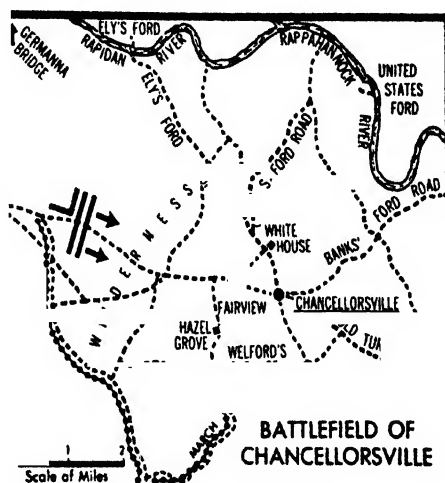
Lee had, in and around Fredericksburg, exclusive of cavalry, about 60,000 men and 170 guns. The two divisions of Lafayette McLaws and Richard H. Anderson of Longstreet's corps, and Thomas J. (Stonewall) Jackson, with the divisions of Ambrose P. Hill and Daniel H. Hill, commanded by Robert E. Rodes; Isaac R. Trimble, commanded by Raleigh E. Colston and Jubal A. Early.

Hooker possessed, exclusive of 12,000 cavalry and 380 guns, about 118,000 men divided into seven corps: 1st, Gen. John F. Reynolds; 2d, Darius N. Couch; 3d, Daniel E. Sickles; 5th, George G. Meade; 6th, John Sedgwick; 11th, Oliver O. Howard; and 12th, Henry W. Slocum. Both armies were in excellent fighting condition.

On the 27th the 11th and 12th corps marched for Kelly's Ford, 25 miles up the Rappahannock, arriving on the 28th and, being joined by the 5th Corps, crossed the river, the first two marching for Germanna Ford on the Rapidan, the 5th Corps for Ely's Ford, lower down the same stream. Alfred Pleasanton's cavalry brigade accompanied the two columns. Some opposition was met at the fords, and at 2 P.M. of the 30th, after some sharp encounters with Stuart's cavalry, on the Germanna road, the three corps united at Chancellorsville, 11 miles west of Fredericksburg, and were joined the same day by two divisions of the 2d Corps, under Couch, which had crossed the Rappahannock at United States Ford, the 3d Corps also being near. The cavalry was thrown out on the roads toward Fredericksburg and Spottsylvania. Hooker had concentrated with great ability 71,000 men on Lee's left and joined them before night. William Mahone's and Posey's brigades of Anderson's Confederate division had been guarding United States Ford; the passage at Germanna Ford turned this position, and the two brigades fell back to Chancellorsville on the 29th, where Anderson had come up with Marcus J. White's brigade. Next morning Anderson fell back with the three brigades to near Tabernacle Church, four miles, and began to throw up works covering the roads converging at that point. These movements on Lee's left were covered by demonstrations on his right and front below Fredericksburg. They began as early as the 21st, and on the 29th Sedgwick, with the 1st, 3d, and 6th corps, moved to points two to four miles below town, threw pontoon bridges across the river and crossed troops to hold them. On the 30th he was ordered to demonstrate on Lee's right down the river, and the 3d Corps marched by the north bank of the river for Chancellorsville. Sedgwick's movements did not deceive Lee. On the afternoon of the 29th Stuart had informed him that heavy Union columns were marching for the Rapidan, and he ordered Anderson to march with Wright's brigade to Chancellorsville. When informed that Hooker had crossed the Rapidan he ordered McLaws, leaving William Barksdale's brigade on Marye's Heights, to march with three brigades at midnight of the 30th, and take position on Anderson's right. Jackson was ordered with three divisions to Chancellorsville, leaving Early's division with Barksdale's brigade—in all, about 8,500 men and 30 guns—to hold the lines at Fredericksburg against Sedgwick. McLaws arrived on Anderson's right about daylight, and was joined by two of Anderson's brigades from near Banks' Ford. Jackson marched at 3 o'clock on the morning of May 1, and came up to Anderson at Tabernacle Church at 8, suspended work on the entrenchments and, at 11 o'clock, ordered McLaws and Anderson forward on the two roads leading to Chancellorsville, his own three divisions following Anderson.

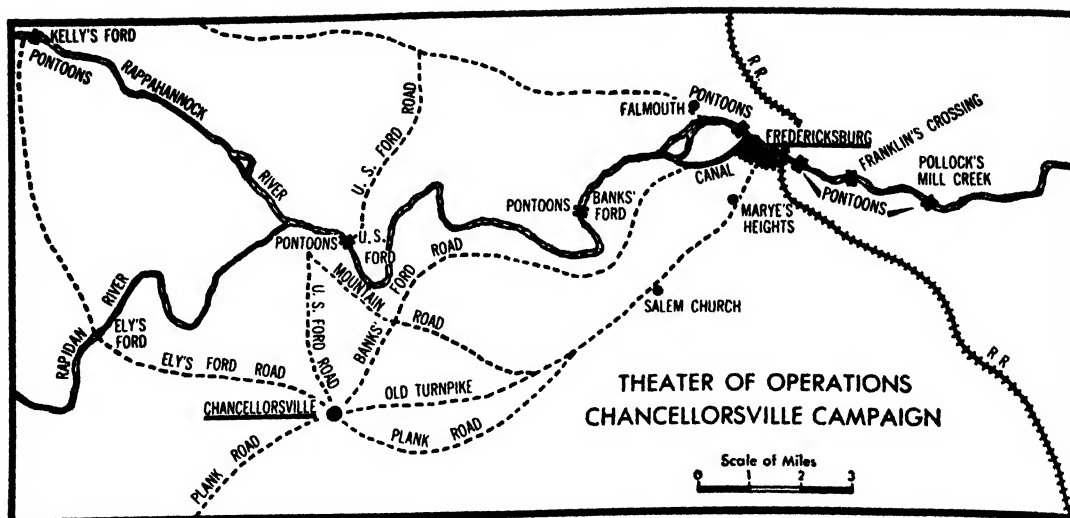
Three roads led from Chancellorsville to Fredericksburg, the most direct, the old turnpike, passing Salem Church. The second, the plank road, led south from Chancellorsville, then east, uniting with the turnpike beyond Tabernacle Church. Both these roads were covered by Anderson's works. The third road led northeastward, passed Banks' Ford, about six miles distant, and continued to Fredericksburg. It was 11 o'clock, May 1, when Meade pushed out two divisions on the Banks' Ford road and one, George Sykes', on the turnpike, under orders to be at

or near Banks' Ford at 2 P.M. At the same hour, 11 A.M., Slocum advanced on the plank road, to be at Tabernacle Church at noon. Hooker's intention being to get out of the Wilderness, uncover Banks' Ford, and form for battle in open, elevated country, his right at Tabernacle Church, his left covering Banks' Ford. Meade's left division had come in sight of Banks' Ford; Sykes, supported by Hancock's division, 2d Corps, had encountered McLaws and driven him back nearly to Anderson's works; Slocum, over two miles out, had met Jackson and was sharply skirmishing with him; and all was going well, when Hooker, impressed by the unexpected advance of the enemy, and fearing his own inability to get entirely out of the tangled forest onto open ground before being beaten in detail, ordered the columns back to Chancellorsville, thereby giving up the advantage of position practically gained, and losing the confidence of his corps commanders. Jackson and McLaws followed the retiring troops and felt out the lines with skirmishers, and McLaws got guns in position and cannonaded the left of the line. Hooker's line, as completed on the morning of May 2, extended



from the Rappahannock on the left to a point on the Germanna plank road fully $2\frac{1}{2}$ miles west of Chancellorsville. The 5th Corps and a division of the 2d Corps were well on the left, facing east, the right, in advance of Chancellor House. The 12th Corps was south of the plank road, its left less than one fourth of a mile in front of the Chancellor House, its right a mile southwest near Hazel Grove.

David B. Burney's division of the 3d Corps was on the right of the 12th, and the 11th continued the line from Dowdall's tavern westward beyond Talley's farm. The works held by the 3d, 12th, and 11th corps faced south, those of the 12th in the form of a bow, the plank road being the string of the bow; those of the 11th ran in a straight line generally just south of the road. For nearly the entire distance the line ran through an almost impenetrable forest of scrub oak and pine. There was a spacious clearing around the Chancellor House, where Hooker had his headquarters, and open ground around Dowdall's. A division of the 2d Corps and two of the 3d were in reserve. Pleasanton's cavalry was near Chancellor's House. On the evening of May 1, Lee had a conference with Jackson. To attack Hook-



er's 71,000 men, behind works, with 48,000. was certain to entail a terrible loss of life, and it was determined that Jackson, with nearly 30,000 men, infantry, cavalry, and artillery, should march across Hooker's front and assail his right flank and rear, Lee remaining with McLaws' and Anderson's 18,000 men to watch his left, demonstrate on it, and guard the roads to Fredericksburg. Jackson moved on the morning of the 2d with his accustomed celerity, and about 5:30 p.m. his head of column was on Hooker's right and rear, and he began to form line a scant mile from the right flank of the 11th Corps. His movement had been discovered and misunderstood. As early as 9 o'clock he was seen marching a mile or so to the south; information of the fact was sent to Slocum and Howard, and the instructions to both to strengthen their flanks. Hooker soon came to the conclusion that Lee was retreating, and about 1 p.m. Sickles, at his own request, was ordered to take two divisions of the 3d Corps, move out and attack, which he did, falling on Jackson's rear at Welford's Furnace, taking some prisoners.

Francis C. Barlow's brigade of the 11th Corps was sent to Sickles, and Pleasanton's cavalry joined him, but the forest was too dense for cavalry operations, and Pleasanton withdrew two of his regiments and battery to Hazel Grove. Williams' division of the 12th Corps was sent to form on Sickles' left, attack Anderson's left and roll him back on Chancellorsville. He was about to attack when Jackson fell on the flank of the 11th Corps and went back to his works. Lulled into security by reports that Jackson was retreating, no adequate provision was made against a flank attack, and the men were preparing supper when the storm broke. Jackson had formed his 26,000 infantry in three lines across the plank road, a mile on either side of it, artillery in the road, and at 5 o'clock gave the order to advance. Union skirmishers were quickly driven in, and, with a wild yell, the main Confederate line struck the right brigade of Charles Devens' division, flanked it, and, after a few rounds had been fired, it gave way, the enemy following. No troops in the world could stay such an attack. Some regiments made a heroic resistance and fought brilliantly, but in 30 minutes Devens' division of 4,000 men was routed, and the Confederates were

able to advance upon Carl Schurz's division which had changed front. Schurz held ground about 20 minutes, and then fell back upon Buschbeck's brigade, east of Dowdall's. Here Schurz rallied some of his men. Buschbeck stood three quarters of an hour, and it was after 7 o'clock when, attacked in front and flank, he fell back in good order to Fairview, where 40 guns of the 11th and 12th corps were being massed on high ground in his rear. Howard's corps had been driven two miles in less than two hours, losing nearly 1,500 killed and wounded, and 1,000 prisoners. The force of Jackson's attack had spent itself; his two leading divisions—Rodes' and Colston's—had become inextricably mixed; the men were tired and hungry, and Jackson suspended their further advance and ordered A. P. Hill to relieve them.

Meanwhile, Hooker had sent Hiram G. Berry's division of the 3d Corps and Alexander Hays' brigade of the 2d Corps to the west edge of the open field north of the road; on Berry's right were some of Schurz's regiments; and Williams, desisting from his attack on Anderson, regained part of his works and formed south of the road on Berry's left, Buschbeck in his rear. This covered the road at a distance of a little over a half mile west of Chancellor's House. Sickles, when informed of Howard's disaster, fell back from Welford Furnace to Hazel Grove and formed on Pleasanton's left. Barlow drew up in Pleasanton's rear, all close to Williams' left and front. The two Confederate lines fell back to the open ground around Dowdall's, to re-form, and A. P. Hill was brought up and his leading brigade pushed along the plank road beyond the intersection of a road leading left to White House, and United States Ford, the road to be taken by Hill to cut off Hooker's retreat. While Jackson was reconnoitering on this road, beyond his main line, skirmishing began between the opposing pickets in the woods, and as Jackson, with his staff and orderlies, was riding back, the mounted body was mistaken for Union cavalry and fired into, Jackson (about 9:20 p.m.) was wounded in three places, both arms being shattered. Nearly the entire escort were also killed or wounded. Jackson died May 10.

At the sound of the firing in the woods the

Union guns on Fairview opened a furious fire down the plank road, causing some confusion to the Confederate column on it. During this fire A. P. Hill, next in command, was wounded; the intended advance was suspended, and Gen. J. E. B. Stuart was sent for to take command. During the night and early morning some changes were made in the Union line by which the approaches on the right to the United States Ford were covered by Reynolds' corps and part of Meade's, and the 11th Corps took position on the extreme left vacated by Meade. At 9 P.M. Hooker, not knowing that Sedgwick's entire corps was at Fredericksburg, ordered him to cross from Falmouth and march up the south side of the river to Chancellorsville and attack Lee's rear at daylight, May 3, while he attacked in front. Pleasanton and Sickles were ordered to fall back from Hazel Grove at dawn. Pleasanton marched back at 4 o'clock, and Sickles was following when his rear was caught by the oncoming Confederate line. Stuart, who had assumed command of Jackson's corps, advanced at 5 o'clock, May 3, with great impetuosity, his right attacking Sickles as his rear brigade was retreating from Hazel Grove. The brigade was soon driven, four guns were captured and Stuart swept on. Thirty Confederate guns were put in position at Hazel Grove which swept the open ground of Fairview and poured an enfilading fire on the right of John W. Geary's division of the 12th Corps which was fighting Anderson, and at the same time Geary's left was being pounded by McLaws' guns. The battle now became fierce along the entire line of the 2d, 3d, and 12th corps. On the right Stuart's men fought William H. French's division of the 2d Corps and the three divisions of the 3d Corps, taking, losing, and retaking the Union works. Williams was fighting Stuart's right, Geary was desperately engaging Anderson, and on his left, covering Fredericksburg road, Hancock's division of the 2d Corps was resisting the fierce attacks of McLaws. Stuart gradually gained ground and united his right with Anderson's left near Hazel Grove. The Union ammunition began to fail, and finally, about 9 o'clock, French, of the 2d Corps, the 3d Corps, and Williams' division of the 12th, after frightful losses, began to fall back, and the Confederates gained the west of the Chancellor plateau and swept it with artillery. A cannon shot struck a pillar of the Chancellor House against which Hooker was leaning. He was knocked down and stunned, and Couch, who was second in command, was instructed by Hooker to withdraw to a position, already selected, about three fourths of a mile north of the Chancellor House, and covering United States Ford. The right and center, closely pressed, fought their way back; Geary, attacked in front, right flank, and rear, followed; Winfield S. Hancock followed Geary. Before noon the troops were in a new position, and here the Battle of Chancellorsville may properly be said to have ended. Before Lee had completed his preparations to renew his attack, he heard of the capture of Marye's Heights and Fredericksburg, and the advance of Sedgwick. Suspending further operations against Hooker he sent McLaws' division to oppose Sedgwick.

When Sedgwick received Hooker's order of 9 P.M., May 2, to cross the river at Fredericksburg, he had already done so, and was three miles below the town. He had 14 miles to march

before he could reach Chancellorsville, and an enemy barred the way. He had about 23,000 men. His three divisions were commanded by Gens. John Newton, William T. H. Brooks, and Albion P. Howe. Brooks was left below Fredericksburg, and Newton led the advance on the town. The advance was slow and difficult, and as dawn came Marye's Heights was seen to be in the hands of the enemy. John Gibbon crossed the river at Falmouth and reported to Sedgwick with his division and, under cover of a demonstration by Newton, advanced on the right to turn the position, but was stopped by the canal and a concentrated fire of artillery. He found also that Hays' brigade of Early's division and Cadmus M. Wilcox's of Anderson's were in his front, and he was obliged to fall back. On the other flank Howe's division failed to make an impression. Nothing remained but to assault the heights and storming columns were formed, Howe forming three on the left and Newton two of two regiments each, strongly supported. These were launched against the Confederate position and were bloodily repulsed by Barksdale's brigade. The assault was renewed and Marye's Heights carried about 11 o'clock, with a loss to Sedgwick of nearly 1,000 killed, wounded and missing in a very few minutes. He took 15 guns and nearly 1,000 prisoners. Here a delay occurred to get Brooks' division up, which was to take the advance, and it was 3 o'clock before Sedgwick marched for Chancellorsville, leaving Gibbon to hold the town and cover the bridges there. His march was impeded by Wilcox, who had regained the road in his front and made a stand half a mile in advance of Salem Church, where McLaws had now come up and formed across the road. Brooks' division advanced and Wilcox fell back to the church, Brooks closely following, and a desperate encounter raged around the church, in which at first Brooks, supported by Newton, was successful, but was finally compelled to fall back after losing 1,500 men. Dispositions were made to renew the struggle, but night came and both sides slept on their arms. Early, who had concentrated his command at Cox's, on the telegraph road, south of Fredericksburg, had Lee's permission to attack Marye's Heights and Sedgwick's rear at daylight. He was joined by Barksdale and, as Marye's Heights were held by only a small Union force, his attack succeeded. Leaving Barksdale to hold the heights and prevent an advance of Gibbon, who was in the town, Early moved toward Salem Church and asked McLaws to cooperate with him.

Meanwhile Lee, retaining only Jackson's three depleted divisions to confront Hooker at Chancellorsville, led Anderson to unite with McLaws and Early, and drive Sedgwick across the Rappahannock, the three divisions aggregating about 21,000 men. Anderson arrived about noon of the 4th and took position between McLaws and Early. Sedgwick was now hemmed in on three sides, his line in shape of a horseshoe, both flanks on the river covering Banks' Ford. The line was five or six miles in length, Newton, on the right, facing McLaws on the west; Brooks, in the center, facing south, confronting Anderson, and Howe, on the left, facing east, opposing Early. Skirmishing was kept up during the day, and at 6 o'clock, Lee, after reconnoitering the position, ordered an attack to break the center. Newton was not seriously attacked but Howe and Brooks were assailed with great spirit, Early,

falling upon the former and endeavoring to turn his left, in which he did not succeed, two of his brigades being repulsed and thrown into confusion by Howe's artillery. An attack on Howe's right and Brooks' left was also repulsed. The Confederates continued the contest until darkness put an end to it. Sedgwick then withdrew from the field to Banks' Ford, where he was covered by 34 guns on the north side of the river, but he had lost so heavily and was hemmed in so closely that, with Hooker's approval, he crossed the river during the night, taking with him nine captured guns and about 1,400 prisoners. His loss, since crossing the river on the 2d, had been 3,200 killed and wounded and 1,500 captured. During the night Gibbon recrossed the river to Falmouth and, on the morning of the 5th, Lee was again in full possession of the south side of the river below Chancellorsville. Early was left to hold Fredericksburg, and Lee marched back with McLaws and Anderson to renew the battle with Hooker. A heavy storm came up, converting dry ravines into torrents and the soil to deep mire, and the attack was deferred until next morning. When day came Hooker had recrossed the river at United States Ford, and the Army of the Potomac marched to its old camp, and Lee returned to his old position at Fredericksburg.

The Union loss at Chancellorsville was 1,082 killed, 6,849 wounded and 4,214 missing. Including the losses at Fredericksburg, Marye's Heights and Salem Church, the Union loss in the entire campaign, April 27 to May 5, was 1,606 killed, 9,762 wounded and 5,919 missing; an aggregate of 17,287. The Confederate loss during the campaign was 1,665 killed, 9,081 wounded and 2,018 captured; an aggregate of 12,764.

E. A. CARMAN.

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CHANCERY, formerly the highest court of justice in England, now consolidated with the other superior courts in the Supreme Court of Judicature.

The Court of Chancery obtained its name from being under the jurisdiction of the lord chancellor and its purpose was never more succinctly expressed than in Cowel and Jacob's *Law Dictionary*: "All the other justices in the Kingdom are tied to the law, but the Chancellor hath the King's absolute power to moderate the written law, govern his judgment by the law of nature and conscience, and ordering all things *juxta æquum et bonum*. . . . He is not limited by the written law, but by conscience and equity, according to the circumstances of the matter." And in the words of King James I, "When the rigour of the law in many cases will undo a man, then the Chancery tempers the law with equity, and so mixes mercy with justice, as it preserves a man from destruction." The jurisdiction of the court was therefore wide; and between it and the common lawyers a long struggle ensued. Its jurisdiction was inoperative

in ordinary common law cases, or in civil cases in which the common law courts could render adequate justice. The great objection of the common law practitioners was that the very extensive powers of the chancellor's court were exercised, not according to fixed rules of law, but at the discretion of the chancellor. In course of time, however, under a succession of able chancellors, the body of law administered by it became quite as fixed as the common law. Thus there came into existence the curious anomaly of two coordinate sets of tribunals adjudicating on the same matters on conflicting principles. It was thus quite possible for a suitor to win in the Court of Chancery who had not the smallest chance of prevailing in the common law courts. In the caustic words of Lord Chancellor Richard Bethell, 1st baron Westbury, one tribunal was set up to do injustice and another to stop it. The distinctive functions of the Court of Chancery remained until the passing of the Judicature Acts of 1873 and 1875. (See below.) The Court of Chancery embraced six superior courts called high courts of chancery and numerous inferior courts. The superior courts were the Court of the Lord High Chancellor, the Court of the Master of the Rolls; the Court of Appeal in Chancery, constituted by the lord chancellor sitting alone with either of the two lords justices in appeal or by the two lords justices sitting together apart from the lord chancellor; and the courts of the three vice-chancellors. The ordinary legal jurisdiction of chancery embraced the issuing of writs for a new Parliament; of pleas of *scire facias* to repeal letters patent, and of all original writs. There was also a jurisdiction acquired by statute or special delegation in issuing writs of habeas corpus and inquiring into charitable uses. There were numerous other powers conferred by act of Parliament, and the lord chancellor, together with the lords justices of appeal, had exclusive authority over the persons and property of idiots and lunatics. Appeals in bankruptcy were heard by the Court of Appeal in Chancery. The sittings and business of this court of appeal were regulated by the lord chancellor.

The procedure of the Court of Chancery at one time, by reason of its traditions and forms, commonly known as red tape, became so cumbersome as partially to defeat its own ostensible aims and rendered reform imperative. Charles Dickens made a determined attack upon the delays of chancery practice in his interesting novel, *Bleak House* (1853), and subsequent changes have been commonly attributed to his influence.

The English Court of Chancery is now a division of the High Court of Justice, which is itself one of the two departments of the Supreme Court of Judicature in which are united all the higher courts of justice in England, exclusive of the appellate jurisdiction of the House of Lords and the privy council. The present judges of chancery as a division of the High Court of Justice are the lord chancellor, who presides over the division, and six justices. According to the provisions of the act by which the Supreme Court of Judicature was established, the distribution of business, both as to its commencement and its transfer, was made subject to rules of court and orders of transfer. By the operation of these provisions chancery, like the other divisions of the court to which

it now belongs, was gradually to cease to be a separate department; but in the meanwhile, subject to these rules and orders, certain causes and matters were assigned to chancery until these provisions should take their full effect. These are enumerated in the Supreme Court of Judicature Act (36 & 37 Vict. c. 66, § 34), and are (1) all causes and matters pending in the High Court of Chancery at the commencement of the act (finally fixed for Nov. 1, 1875); (2) all causes and matters to be commenced after the commencement of the act under any act of Parliament by which exclusive jurisdiction in respect to such causes or matters has been given to the Court of Chancery, or to any judges or judge thereof, except appeals from county courts; (3) administration of the estates of deceased persons; partnerships; mortgages; raising of portions or other charges on land; sale and distribution of the proceeds of property subject to any lien or charge; trusts, charitable or private; rectification or setting aside or cancellation of deeds or other written instruments; performance of contracts between vendors and purchasers of real estates, including contracts for leases; partition and sale of real estate; wardship of infants and the care of infants' estates. Chancery, as a division of the High Court of Justice, has no exclusive right to the administration of equity, the act already mentioned making provision under certain rules for the concurrent administration of law and equity in all the divisions of the Supreme Court of Judicature. The Court of Appeal in Chancery no longer exists and its functions are transferred to the Court of Appeal, which in the new Supreme Court of Judicature is the complementary department of the High Court of Justice. The affairs of lunatics are still under the supervision of the old chancellor. See also EQUITY.

In the United States the general tendency has been likewise to abolish courts of chancery as separate departments, and equity jurisdiction is generally conferred on the courts of law. Delaware, New Jersey and Tennessee are among the few states that still retain the former practice.

In the Catholic Church the chancery denotes (1) the office in a diocese whence come those documents necessary for the exercise of parochial power; (2) the office in Rome which drafts and expedites the bulls or briefs by which the mind of the pope is made known to Christendom or to particular suitors.

CHANCRE. See SYPHILIS.

CHANCROID, shǎng'kroid, a contagious venereal disease, characterized by the presence of one or more suppurating ulcers, located chiefly in the genital region of either sex. These are due to infection by microorganisms lurking in dirty skins, and are not syphilitic in origin, although often coexisting with true syphilitic lesions. Even though this is the case, the two can be distinguished, since the chancroid is soft and not indurated. Chancroid is essentially a filth disease, although venereal, and arises from personal uncleanness. The specific organism is the *Hemophilus ducreyi*. Chancroid develops usually within 24 to 48 hours after infection, a much shorter interval than in syphilis. At first a small papule surrounded by a reddish areola appears, which soon spreads to become an ulcer. These ulcers are extremely painful, and may be followed by enlargement and suppuration of the

glands of the groin (bubo). The chancroid persists as a rule from three to six weeks, and is often extremely resistant to treatment. If the complication of suppurating inguinal glands occurs, convalescence may be protracted and drainage may be required. In some cases infection of other areas of sound skin may take place.

HAROLD WELLINGTON JONES, M.D.

CHANDA, chān'dā, town in the district of Chanda in the Nagpur division of the Central Provinces, Indian Union, 85 miles south of the town of Nagpur. It was the old capital of the ancient Gond dynasty. It is surrounded by a stone wall five and a half miles in circuit, from 15 to 20 feet high, 10 feet thick and flanked with rough towers large enough for the heaviest guns; inside which are cultivated fields and detached villages, while there are also suburban quarters outside. Without the walls is a large water tank constructed under Gond rule and a collection of ancient statuary known as Rayappā's idols, the largest of which is 26 by 18 by 3 feet. Chanda is the commercial center of the district with manufactures of silk, cotton, dyestuffs, slippers, bamboo work and gold and silver work. It has numerous schools and a mission station. The district contains considerable iron and coal deposits. Pop. (1941) 35,730; the district has an area of 10,156 square miles and a population of (1941) 873,284.

CHANDAUSI, chūn-dou'sē, a town in the western section of the United Provinces, Indian Union, 95 miles east of Delhi. It is an important rail and trade center. Pop. (1941) 26,768.

CHANDELEUR, shān-dē-lūr', **ISLANDS**, a group of about 15 small islands in the Gulf of Mexico about 25 miles off the east coast of Louisiana, from which they are separated by Chandeleur Sound. There is a lighthouse on the northern end of the northernmost island which is in latitude 30° 2' north and longitude 88° 52' west.

CHANDELIER. An apparatus suspended from the ceiling or vault and supporting two or more lighting units. Usually, in modern times,

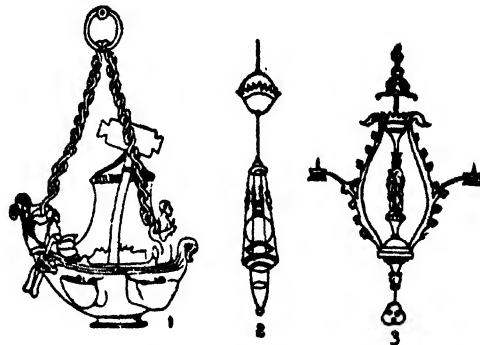


Fig. 1.--(1) Roman Christian Lucerna pensilis for four wicks (from the Catacombs). (2) Corona style Chandelier (from an old MS.). (3) German church Chandelier of the Middle Ages.

the lights are supported on arms or branches radiating from a central shaft. The chandelier may be said to have originated in the ancient suspended oil lamp (*lychnus*) of several wicks (*polymixos*) used by the Romans. (See Fig. 1). By the 4th century A.D. the Catholic Church began to use *coronae*, *phari*,

pharicanthari, circuli luminum, polycandelae, etc., carrying a multitude of candles (Pope Adrian presented St. Peter's, Rome, with one carrying 1,370 candles in the 8th century). These were all terms for the *corona lucis* (see CORONA), or crown light. Great and beautiful examples of these elaborate crown lights are still in existence in the "heavenly Jerusalem" design, with their small towers or "tabernacles" or "gates" for the Apostles. That presented by Frederick Barbarossa to the minster at Aix-la-Chapelle is 13 feet in diameter. (See Fig. 2.) Another is in the Hildesheim Cathedral (circa 1050), 20 feet in diameter with 72 candle holders.

Most of the elaborate crown lights were constructed in the 11th and 12th centuries, and while many carried candles, others were for oil lamps. Their construction was, for the most part, of metal (copper, iron, silver, even gold) and ornamented with enamels, etc.; some were of wood. In the 13th century elaborate forged

deliers at this time which are yet much admired. To this century belongs the famous historic "Galiëo" chandelier in the Cathedral of Pisa, a magnificent work of bronze of the Italian Renaissance, whose swinging is said to have led to the pendulum in horology.

In the 17th century a few wooden chandeliers were still produced, but with artistic carved decoration—most of them were constructed for temporary (festivals, etc.) use. Under Louis XIII Dutch copper chandeliers became popular. This style had a central shaft composed of a number of balls relieved by balustre forms. A common device was to have the chandelier surmounted by a royal crown, ducal or other coronet. Very elaborate chandeliers were produced in this century in wrought iron, bronze and copper (Flanders was doing very fine work in copper castings). Silver was used to some extent, also rock crystal was becoming quite the vogue; but the former

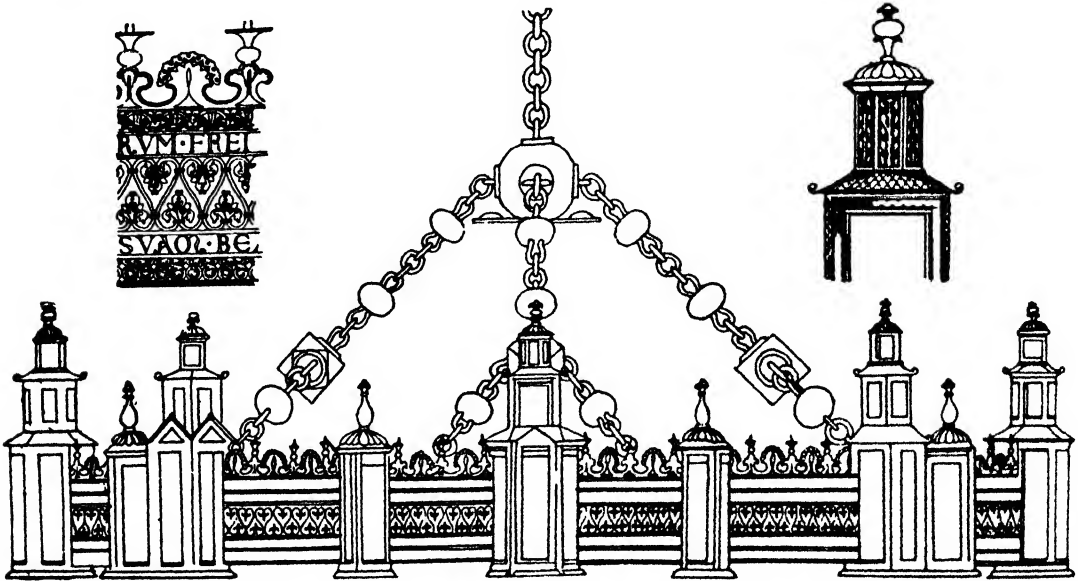


FIG. 2.—The great 13th century Corona Chandelier at Aix-la-Chapelle Minster. Details: left, section of railing; right, style of tower decoration.

ironwork was in great vogue, therefore chandeliers were fashioned in this manner. In the 14th century chandeliers began to take on a star or radiation form with six to eight branches supporting a number of candles or lamps. These were mostly of bronze. In this period a species of trophy device in chandeliers took form in Germany, made up of the horns of the animals of the chase (stag, elk, elephant, etc.). This fashion remained popular till the 18th century. In the 15th century wooden crosses acted as chandeliers frequently. Oak was much favored, and, while many were quite plain, others, for church use, had elaborately carved centerpieces from which radiated handsomely decorated curved arms of forged iron supporting candle sockets; others were entirely of bronze or copper, a few of silver. The plain crown light still persisted.

The 16th century retained much of the radiate style of the preceding century but rock-crystal decoration (which had been practiced in a modest way since the 13th century) appears (from documentary evidence) to have become more general. Flanders produced lovely chan-

deliers at this time which are yet much admired. The crystal ornament was becoming a part in the establishments of the wealthy.

In the 18th century the thorough combustion (sootless) of oil was becoming effective (Argand, Lange, Quinquet inventions), and we have suspended lamps largely replacing candles in chandeliers. Under Louis XV and Louis XVI were constructed for lay use more chandeliers of great importance than ever before, the church having had the very large and elaborate pieces. The furnishing of civic homes with luxurious decoration was a new growth, and, by the second half of the 18th century, practically all chandeliers had crystal ornament. Every chandelier by this time had arms or branches; the "console" or reclining *u* was the form prevalent. A common style of crystal decoration consisted of interlacing strings of faceted crystal beads—often so elaborate as to be cumbersome. Ordinary glass sufficed usually, but rock crystal was favored by the wealthy. The chandelier, in some form, was now common property among

all classes of city dwellers, except the very poorest. In chandeliers de luxe we find porcelain (Dresden and Sèvres) flowers figuring as ornament, and soon the usage of these fictile

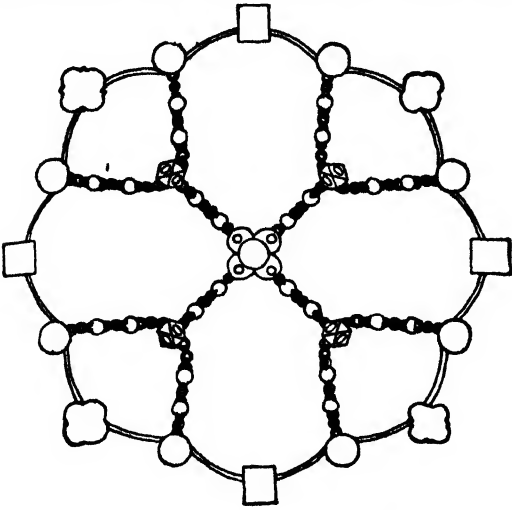


FIG. 3.—Horizontal plan (bird's-eye view) of Aix-la-Chapelle Corona Chandelier.

flowers became so common that porcelain flower making became a distinct Paris industry. Some chandeliers of the Louis XVI period had

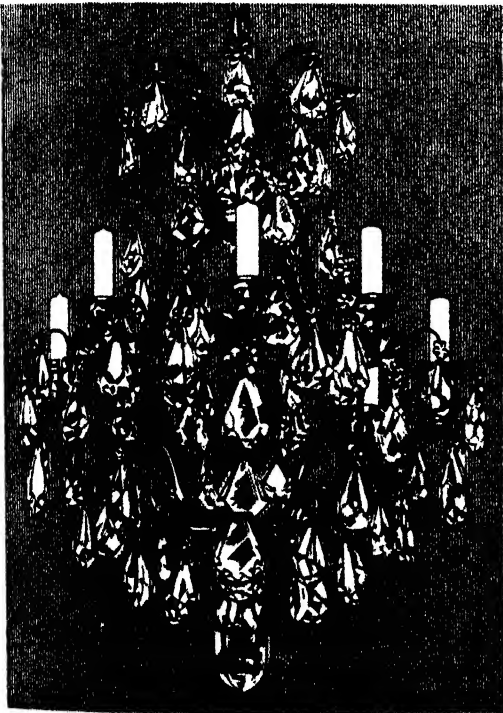


FIG. 4.—A fine Louis XIV (17th and early 18th centuries) Rock Crystal 8-light chandelier.

their faceted beads made of stass, some of polished steel.

During the early years of the 19th century but one style prevailed in the construction of chandeliers, bronze-gilt frames so swarming with crystal decoration as to make the chandelier body a mere accessory hidden in garlands of crystal beads. Immense, gorgeous constructions were

made for use in the theaters, and so forth, the most noted being that of the Grand Opera House, Paris, by Jean Louis Charles Garnier. With the introduction of hydrogen gas for lighting purpose no great transformations occurred in the forms used for chandelier (often termed *gasolier*) construction, pipes taking the place of bar metal and gas nipples displacing the old candle pricket or the later sockets. The designer had a wider field to work in when illumination by electricity was introduced. Strikingly artistic forms were evolved in the *electrolier*, some reverting to the classic Greco-Roman *lychnus*, others showing modern originality.

CLEMENT W. COUMBE.

CHANDERNAGOR, chūn-dēr-nà-gōr', or **CHANDARNAGAR**, chūn-dēr-nūg'ēr, city, India, on the Hooghly River, 21 miles north of Calcutta. With adjoining territory (the total area being 4 square miles), it was a settlement of French India until 1950, when France yielded it to India after a referendum of June 19, 1949, had revealed the inhabitants' preference for Indian rule. The only manufacture is cotton cloth. Established as a trading center by the French East India Company in 1676, it was ceded to France in 1688 by Emperor Aurangzeb. Chandernagor was captured by the British in 1757 but restored in 1763. Again seized by the British in 1794, they once again yielded it to France in 1816. The treaty of cession to India was ratified June 9, 1952. Pop. (1948) 44,786.

CHANDIGARH, chūn'dē-gūr, city, India, capital of the Punjab, near the Ghaggar River, on the Delhi Kalka rail line, 25 miles north-northwest of Ambala. India's youngest city, the Punjab government announced plans for construction in 1948 and engaged Le Corbusier (Charles Édouard Jeanneret), the famous Swiss architect, as its designer. Construction was started on a 15-square mile site in 1950; it was formally inaugurated as the state capital on Oct. 7, 1953. The town is dominated by the capitol buildings—the High Court, Legislative Chamber, Secretariat, and the Raj Bhavan. It incorporates the most modern ideas of town planning and many unique architectural features. A resident population of 150,000 is envisioned by 1958. Pop. (1954) 10,000.

CHANDLER, Abiel, American merchant: b. Concord, N. H., 1778; d. Walpole, March 22, 1851. He was graduated at Harvard College in 1806, and was for many years a merchant in Boston. He died a widower, without children, and devised \$50,000 to Dartmouth College. The Chandler School of Science at Dartmouth was established in 1851 in pursuance of this bequest.

CHANDLER, Asa Crawford, American biologist: b. Newark, N. J., Feb. 19, 1891. A graduate of Cornell (B.A. 1911), he received his M.Sc. and Ph.D. degrees from the University of California (1912 and 1914). After teaching in American universities he engaged in hookworm research at the School of Tropical Medicine, Calcutta, for three years. Returning to the United States in 1927 he was appointed professor of biology at Rice Institute, Houston, Texas. From 1942 to 1947 he also was special consultant to the United States Public Health Service. His works include *Hookworm Disease* (1929) and *Introduction to Parasitology*, 8th ed. (1949).

CHANDLER, Charles Frederick, American chemist: b. Lancaster, Mass., Dec. 6, 1836; d. New York, Aug. 25, 1925. He studied at the Lawrence Scientific School of Harvard, and in Germany at Göttingen and Berlin. From 1857 to 1864 he was professor of chemistry at Union College, Schenectady, N. Y., then accepting a like chair at Columbia University. There he collaborated with Thomas Egleston (1832-1900) in founding the School of Mines, the first of its type to be established in the United States. Chandler continued at Columbia as professor of chemistry until 1910, serving also as dean during 1864-1897 and as professor of chemistry at the Columbia College of Physicians and Surgeons from 1876 to 1897. In 1866 he was appointed chemist of the New York City Board of Health. He was made president of the board in 1873, an office which he filled until 1883. Regarded as an authority on water supply and sanitation, he campaigned for compulsory vaccination and enforcement of pure food laws and against the adulteration of milk. The New York State Board of Health was established largely on account of his efforts, and he was one of the founders of the American Chemical Society, which he served for two terms as president.

CHANDLER, Francis Ward, American architect: b. Boston, Sept. 30, 1844; d. North Haven, Me., Sept. 8, 1926. He was graduated at the Lancaster Academy in 1861, and in the American Civil War he served with the 53d Massachusetts Volunteers. Taking up the study of architecture, he worked with Ware and Van Brunt, Boston, during 1864-1867. He spent 1867-1869 in Paris and during 1869-1870 he was assistant in the architectural department of the Massachusetts Institute of Technology. In 1871 he became assistant architect in the Treasury Department, Washington. From 1874 to 1888 he was a partner of E. C. Cabot, Boston, and in 1888 he was appointed professor of architecture in the Massachusetts Institute of Technology; he became professor emeritus in 1911. He published *Construction Details* (1892); *Notes on Limes, Cements, Mortars, and Concretes* (1892); and edited *Municipal Architecture in Boston* (1898) and many articles in the *Technology Quarterly*.

CHANDLER, Frank Wadleigh, American educator: b. Brooklyn, N. Y., June 16, 1873; d. Prouts Neck, Me., June 13, 1947. He was graduated from Brooklyn Polytechnic Institute in 1894, and from 1895 to 1899 he studied at Columbia University, at Oxford, in London, and Paris. From 1899 to 1910 he was professor of literature and history at Brooklyn Polytechnic Institute, and from 1901 to 1904 he lectured at Columbia on comparative literature. He served as professor of English and comparative literature at the University of Cincinnati from 1910 until his retirement in 1943; during 1913-1928 he was also dean of the university's college of liberal arts. For 19 consecutive summer sessions he also taught comparative literature at Columbia. His writings included *The Literature of Roquery* (1907) and *Modern Continental Playwrights* (1931).

CHANDLER, Richard, English classical antiquary: b. Elson, Hampshire, 1738; d. Tilehurst, Berkshire, Feb. 9, 1810. He was educated at Winchester, and at Queen's and Magdalen colleges, Oxford. His first important work was

Marmora Oxoniensia (1763), an elaborate description of the Arundel marbles. He afterward traveled through Greece and Asia Minor, at the expense of the Dilettanti Society, to examine and describe the antiquities. The materials collected were given to the world in the following publications: *Ionian Antiquities* (1769); *Ancient Inscriptions* (1774); *Travels in Asia Minor* (1775); and *Travels in Greece* (1776). He was an Anglican clergyman, and at his death was rector of Tilehurst, near Reading.

CHANDLER, Seth Carlo, American astronomer: b. Boston, Mass., Sept. 17, 1846; d. Wellesley, Mass., Dec. 31, 1913. From 1864 to 1870 he was on the staff of the United States Coast Survey, and he was associated with Harvard Observatory from 1881 to 1885. The Astronomical Society of London awarded him its gold medal in 1896 for his determination of the laws of variations of latitude or movements of the earth's pole, and his researches on variable stars. From 1896 he edited the *Astronomical Journal*. He made important investigations and observations of the phenomena of variable stars, the computation of comet orbits, and devised a system of astronomical code telegrams for the announcement of astronomical discoveries. He also invented the almucantar, and published a very complete treatise on the method of its use.

CHANDLER, William Eaton, American politician: b. Concord, N. H., Dec. 28, 1835; d. there, Nov. 30, 1917. In 1855 he graduated at Harvard Law School. He entered the New Hampshire legislature in 1862, and during 1863-1864 served as speaker. During 1865-1867 he was assistant secretary of the United States Treasury. From 1882 until 1885 he served as secretary of the navy; and he was a United States senator from 1887 to 1901. He served during 1901 as president of the Spanish Treaty Claims Commission.

CHANDLER, Zachariah, American merchant and statesman: b. Bedford, N. H., Dec. 10, 1813; d. Chicago, Ill., Nov. 1, 1879. He received a common school education, and early in life went to Detroit, where he engaged in the dry goods business; his energy and ability soon brought success and put him in possession of a handsome fortune. He was mayor of Detroit in 1851, and defeated Whig candidate for governor of Michigan in 1852, and an active organizer of the Republican Party in 1854. In January 1857 he was elected to the United States Senate to succeed Gen. Lewis Cass. The same energy and ability which had made him successful in business, he now applied to the organization of the Republican Party, and he was soon recognized as one of the most formidable opponents of all plans in favor of slavery. He opposed the admission of Kansas under the Lecompton Constitution (q.v.) in 1858, and he was the author of the famous "blood letter," in which he said "without a little blood-letting, this Union will not, in my estimation, be worth a rush." Though a friend of Lincoln, he was more radical than the latter, and often differed from him in matters of public policy. He was reelected to the senate in 1863 and served until 1875, when he became secretary of the interior in the administration of President Ulysses S. Grant, an office he occupied until 1877. Again elected to the Senate in 1879, he led the attacks on Jefferson Davis.

CHANDOS, shǎn'dōs, titles in the English peerage borne by members of the Brydges family.

SIR JOHN BRYDGES (1490?-1556), 1st Baron Chandos of Sudeley descended through his mother from Sir John Chandos, was a supporter of Edward VI and Mary, and during 1553-1554 was lieutenant of the Tower of London. There he had custody of Lady Jane Grey and of Sir Thomas Wyatt (whose rebellion he had helped suppress). He was created 1st Baron Chandos of Sudeley in 1554.

JAMES BRYDGES, 8TH BARON CHANDOS (1673-1744), was paymaster general of the forces abroad during the War of the Spanish Succession (1705-1713). In 1714 he was created earl of Carnarvon; and in 1719 he became marquis of Carnarvon and duke of Chandos. He was a patron of George Frederick Handel who spent two years at Canons, Baron Chandos's magnificent home near Edgware, Middlesex, there composing the oratorio *Esther* (1720).

CHANDOS, **SIR JOHN**, English soldier: d. near Poitiers, France, Jan. 1, 1370. He was descended from Robert de Chandos, who came from Normandy with William the Conqueror in 1066. The earliest military records about John Chandos state that he was at the siege of Cambrai in 1337, at Crécy in 1346, and Poitiers in 1356, when he rescued his friend, the Black Prince, on the battlefield. He was soon afterward appointed "regent and lieutenant" of the king of England in France, and vice chamberlain of the royal household. In 1364 he commanded the English forces against Charles de Blois; the latter was killed at the Battle of Auray and the redoubtable Bertrand du Guesclin fell a prisoner to Chandos. In 1367 the Black Prince induced him to join a military expedition across the Pyrenees into Spain against Henry of Trastámara, who was aided by du Guesclin. In the ensuing battle at Navarrete, Chandos gained the victory and again captured du Guesclin. Retiring in 1368, Chandos was again called to arms against the French in 1369. He was mortally wounded in an engagement at the bridge of Lussac and died the following day. One of the original Knights of the Garter, he was esteemed at a gallant, chivalrous warrior.

CHANDRAGUPTA or **CHANDRAGUPTA MAURYA**, chūn-drā-gōp'tā mā'-ōor-yā (known in Greek as SANDROCOTTUS or SANDRACOTTUS), Indian ruler, first king of Magadha of the Maurya dynasty: d. 286? B.C. While in exile during his youth he made the acquaintance of Alexander the Great. Leading a revolutionary movement against the regime in Magadha, he established the Maurya dynasty and destroyed the Macedonian garrisons left in India by Alexander. He created an empire which extended right across northern India and northward as far as Afghanistan. In 305 B.C. he defeated Seleucus I (Nicator) in the Punjab, compelling him to surrender all claims to that and other Indian territories. An account of the court of Chandragupta was written by Megasthenes, the Greek historian, who was sent to it as ambassador by Seleucus in 302 B.C.

CHANEY, chā'nī, Lon, American motion picture actor: b. Colorado Springs, Colo., April 1, 1883; d. Los Angeles, Calif., Aug. 26, 1930. The son of deaf-mute parents, Lon Chaney undoubtedly owed much of his mastery of pantomime

to the fact that in childhood he necessarily communicated with his parents by gestures and facial expression. He left school before attaining the fifth grade to become a tourist guide on Pikes Peak. His first theater job was as property boy; later he became a stage hand. With his older brother John, a theater manager, he wrote *The Little Tycoon*, the play in which he made his stage debut. This was followed by performances in Gilbert and Sullivan operas. In Chicago he found stage employment as a comedian and song and dance man. He then joined a vaudeville troupe with which he went to California. His first experience in the movies was as an extra, after which he directed seven Western pictures. Returning to the screen, he played the villain in *Hell Morgan's Girl* (1917). His first outstanding characterization was the frog in *The Miracle Man* (1919). Other pictures in which he scored great successes included *The Hunchback of Notre Dame* (1923); *Road to Mandalay* (1926); *Mr. Wu* (1927); and *Laugh, Clown, Laugh* (1928). His portrayals of characters warped by a psychological or physical abnormality were masterly.

CHANG AND ENG. See SIAMESE TWINS.

CHANG TSO-LIN, jǎng' tsō'lin', Chinese military leader: b. Liaoning Province, 1876; d. Mukden, June 4, 1928. A man of lowly origin, in 1904 he emerged from obscurity as leader of a band of Manchurian bandits. He joined the Chinese Army in 1905, and by 1911 he was military governor of Fengtien. From 1918 he was in autocratic control of Manchuria, where he extended his influence into numerous civil activities. He made several attempts to establish a stable national government at Peking (Peiping), and in 1927 formed a Cabinet of his adherents there, with himself as president with the style of generalissimo. With the approach of the Southern Nationalists he left the city, and he was killed en route to Mukden when his train was bombed.

CHANGA, a species of mole cricket (*Scapteriscus didactylus*). See MOLE CRICKET.

CHANGARNIER, shān-gār-nyā', Nicolas Anne Théodule, French army officer: b. Autun, April 26, 1793; d. Versailles, Feb. 14, 1877. He entered the army as lieutenant in 1815, and in 1830 he was sent to Algeria, there serving with distinction for 18 years. Shortly after being appointed governor of Algeria in 1848 he was recalled to France to assume command of the National Guard and troops in Paris. Although he suppressed the radical elements he subsequently disagreed with the policy of Louis Napoleon, and at the coup d'état in December 1851 he was arrested. In January 1852 he was banished from France, remaining in exile until after the amnesty in 1859. With outbreak of the Franco-Prussian War he offered his services to Napoleon III. He was serving in Metz under Marshal Bazaine when that city capitulated on Oct. 27, 1870, becoming a prisoner of war. In 1871 he was elected a member of the National Assembly, serving until 1875, when he became a senator for life.

CHANGCHUN, chāng'chōn' (Japanese official name HSINKING, shin'jing'), city, Manchuria, capital of Kirin Province, on the railroad

165 miles north-northeast of Mukden. It is an important railroad junction. From the city are shipped large quantities of soybeans cultivated in the fertile valley of the Sungari River. Migration of Chinese farmers from the Shantung Province late in the 18th century caused Changchun to expand from a small village to a large town, and in 1932 it was chosen by the Japanese as the capital of its puppet state of Manchukuo. On Aug. 22, 1945, as World War II was closing, Russian paratroopers captured the city, and during the ensuing two years it was frequently the scene of conflict in the Chinese civil war. Pop. (est. 1945) 787,778.

CHANGE OF FUNCTION. During the metamorphosis of insects, Crustacea, and other animals, organs at first adapted for certain uses become, with change of conditions of life, media, and consequently of habits, adapted to quite different uses or functions. Thus in the young larva (nauplius) of many of the lower Crustacea, the three pairs of head appendages are formed for swimming; the first two pairs afterward change into the two pairs of antennae, the third pair becoming the jaws of the adult. In the tadpole, which lives on dead leaves or animal matter, the intestine is very long and coiled, but in after life, when the frog feeds on living insects, it is very much changed in form, being much shorter. These are examples of an ontogenetic change of function. There are many examples of change of function by suppression of the original or chief function, what was a minor use becoming the chief one. Examples of a phylogenetic change of function are the transformation of the jaws of biting insects into the needlelike elements, aiding in the formation of the beak of bugs (q.v.); the transformation of the hypopharynx of caddis flies into the piercing organ of fleas and flies; the modification of the maxillae of biting insects into the spiral tongue of the butterfly. The mouth parts of bees and butterflies lost their primitive functions and adopted entirely new shapes and uses after flowers appeared. Among fishes the clearest example is the change of the swimming bladder of the gar pike, where it also functions as a breathing organ, until in the lungfishes, which have probably descended from some ganoid, it becomes a lung.

CHANGE OF LIFE. See MENOPAUSE.

CHANGELING, a child left or taken in the place of another. It was at one time a common superstition that young children were liable to be stolen or changed by fairies before being baptized; and hence they were carefully watched till that ceremony was over. It was thought that the fairies were always anxious to change their own starveling elves for the more robust children of men. The children so left were called changelings, and were known by their greater backwardness in growth or learning; hence, stunted or idiotic children were regarded as changelings. The poets allude to this superstition occasionally, for example, William Shakespeare and Edmund Spenser.

CHANGO, chāng'gò, a tribe of South American Indians inhabiting the rainless region of northern Chile, near the Atacama Desert. Their territory was formerly much larger, and their language, now extinct, appears to have been a distinct stock.

CHANGSHA, chāng'shā', city, China, capital of Hunan Province, situated on the right bank of the Siang River 45 miles south of Lake Tungting Hu. A wall pierced by 12 gates formerly surrounded the city; the first such wall was said to have been built about 202 B.C. Changsha was a notable literary center at an earlier period; the city's university has existed for some 700 years. Foreign missionaries were first permitted to work at Changsha in 1901. An American college known as Yale-in-China was established in the vicinity. Manufactures include silk, linen, and brassware. The city became a treaty port in 1904. It was unsuccessfully besieged by Taiping rebels in 1852. There were revolutionary outbreaks in Changsha in 1910-1911, and again in 1930; in 1941, during World War II, the city was occupied temporarily by the Japanese, and they were again in possession from June 21, 1944, until the end of the conflict. Pop. (est. 1936) 311,600.

CHANGTEH, chāng'dū', city, China, in Hunan Province, on the left bank of the Yuan (Yuen) River near its mouth. It is in the midst of China's most fertile rice-growing area and has a considerable river-borne trade. The city was one of the treaty ports. During World War II Changteh suffered much damage in attacks by Japanese aircraft prior to its capture in 1944. Pop. (est.) 300,000.

CHANK, chāngk, the large, spiral shell of a gastropod mollusk (*Turbinella pyrum*) found in water from 12 to 15 feet deep along the shores of Ceylon and India. The shell is a sacred emblem of Vishnu, who is often represented as holding a "sinistral" one in his hand. They are used by the Hindu women as bangles and leg ornaments, or anklets. The chank appears as a symbol on the coins of some of the ancient Indian empires.

CHANLER, Amélie Rives. See RIVES, AMÉLIE, PRINCESS TROUBETZKOY.

CHANLER, chān-lēr, William Astor, American explorer: b. Newport, R. I., June 11, 1867; d. Mentone, France, March 4, 1934. He studied at Harvard, but left the university to make explorations in Africa. With Chevalier Ludwig von Höhnelt, he started from Zanzibar in September 1892 to explore the region east and west of Mount Kenya. They reached the coast on the return journey June 1893. He was elected to the New York legislature in 1897 and to Congress in 1898 as a Democrat. He served in the Spanish American War and was commended in General William R. Shafter's reports. He wrote *Through Jungle and Desert* and *Travels in East-ern Africa*.

CHANNEL ISLANDS, an archipelago in the English Channel, 10 to 30 miles off the west coast of Manche Department of France, belonging to Great Britain. The group, with an aggregate area of 75 square miles, comprises Jersey (45 square miles; pop., 1948, 57,133), Guernsey (25 square miles; pop., 1949, 44,592), and the following dependencies of Guernsey: Alderney, Brechou, Great Sark, Little Sark, Herm, Jethou, and Lihou. St. Helier, the principal town of Jersey, is on the south coast, 122 miles south-southwest of Southampton; the principal town of Guernsey is

St. Peter Port. The islands, which are picturesque and very fertile, export large quantities of fruit, vegetables, and flowers to the English market. The chief fertilizer is vraic, a type of seaweed, the regular gathering of which, controlled by legislation, is one of the characteristic insular scenes. Much kelp is used in the manufacture of iodine. The Channel Islands are celebrated for a special breed of cattle, originally called Alderney but now differentiated as Jerseys and Guernseys which differ in several minor characteristics. There are important fisheries of turbot, conger eels, oysters, lobsters, and monster crabs. The quarries of Jersey and Guernsey are extensively worked, and export fine granite for building purposes. Lieutenant governors head the administrations of the two largest islands. In both Jersey and Guernsey is a bailiff who presides over the Assembly of the States (the legislature) and is also president of the Royal Court (the judiciary). While French is the official tongue for ceremonial or official occasions, English is permissible in the legislatures, most members of which are elected. Among the farming population the vernacular is old Norman French, which differs in peculiarities of spelling and pronunciation in each island and even in parishes of the same island. Ecclesiastically, the Channel Islands belong to the Anglican diocese of Winchester. Scheduled ship and air services link the islands with both Britain and France.

Cave dwellings and numerous megalithic cromlechs, tumuli, and menhirs prove the habitation of a prehistoric race. The Romans occupied the islands during the 3d and 4th centuries; Caesarea (Jersey) and Sarnia (Guernsey) occur in the *Antonini Itinerarium*. Earthworks, fortifications, and castles dating from Roman and subsequent periods exist. Christianization dates from the 5th or 6th centuries; St. Helier, chief town of Jersey, was named for one of the early evangelists. In 933 the Channel Islands passed into the possession of the dukes of Normandy. A few old Norman chapels remain, and the oldest extant churches—Saint Brelade's, on Jersey, and Saint Sampson's, on Guernsey—date from 1111. The islands became part of the British realm at the time of the Norman Conquest in 1066, and remained so after 1204, when Normandy was conquered by the French. In 1360, by the Treaty of Bretigny, Philip II of France recognized British claims to the islands, but subsequently there were many attempts on the part of France to capture them. Between 1460 and 1465, during the Wars of the Roses, the French actually held part of Jersey. During the Civil War there were rival royalist and parliamentary administrations in Jersey and Guernsey, the islands suffering severely as a result. French forces made two attempts to capture Jersey in the American Revolution, but both proved unsuccessful. The islands have frequently been an asylum for political refugees. Prince Charles (later Charles II) and Edward Hyde, 1st Earl of Clarendon, went to Jersey in the Civil War, and many Frenchmen fled to the islands during the revolutionary period in France. Victor Hugo lived as an exile in Jersey (1852–1855) and Guernsey (1855–1870), and Gen. Georges Boulanger went to live in Jersey in 1889. With the surrender of France in 1940 the islands were demilitarized and partly evacuated, and they remained in German occupation until the end of World War II in Europe. Some of the islands, notably Alderney, were used for the imprisonment

of Russian soldiers and the internment of Jews. The German garrison of about 27,500 men was surrendered to British forces on May 12, 1945. Considerable criticism was subsequently voiced in Britain concerning the lengths to which some local officials had gone in cooperating with the Germans.

Consult Foord, E., *The Channel Islands* (London 1928); Guerin, B. C. de, *The Norman Isles* (Oxford 1949).

CHANNELBILL, chān'ēl-bīl, a gigantic Australasian cuckoo (*Scythrops novaehollandiae*), having the size, flight, and general appearance of a hawk, brown and gray above and whitish below, with bare scarlet skin surrounding the eyes. It takes its name from two deep grooves in the side of the bill. It is probably parasitic, feeds on both fruit and insects, is migratory, and utters a shrieking cry like the syllable "krok."

CHANNELS, of a ship, pieces of wood or iron projecting edgewise like a ledge from the ship's outside, abreast of and extending somewhat behind the masts. They serve to extend the shrouds.

CHANNING, Edward, American historian: b. Dorchester, Mass., June 15, 1856; d. Cambridge, Mass., Jan. 7, 1931. He was the son of William Ellery Channing, 1818–1901 (q.v.). In 1878 he graduated at Harvard, and in 1883 he became instructor in history there, then assistant and full professor, and later McLean professor of ancient and modern history. He wrote *The Narragansett Planters* (1886); and *Town and County Government of the English Colonies in North America* (Johns Hopkins Studies, 1883–1884); *Columbus and His Companions*, in Winsor's *Narrative and Critical History of the United States* (1888); *The United States, 1765–1865* (1896); in collaboration with A. B. Hart and F. J. Turner, *Guide to the Study of American History* (1912); and with T. W. Higginson, *English History for Americans*. His notable *History of the United States* was in six volumes: Vol. I, *The Planting of a Nation in the New World, 1000–1660* (1905); Vol. II, *A Century of Colonial History, 1660–1760* (1908); Vol. III, *The American Revolution, 1761–1789* (1912); Vol. IV, *Federalists and Republicans, 1789–1815* (1917); Vol. V, *The Period of Transition, 1815–1848* (1921); Vol. VI, *The War for Southern Independence* (1925), awarded the Pulitzer prize as the best volume of the year on this history of the United States.

CHANNING, chān'ing, Edward Tyrrel, American scholar: b. Newport, R. I., Dec. 12, 1790; d. Cambridge, Mass., Feb. 8, 1856. He was a brother of William Ellery Channing, 1780–1842 (q.v.). He studied law and was admitted to the bar, but gave his attention chiefly to literature. The *North American Review*, the earliest permanent publication in the United States, was issued in May 1815 as a bimonthly; the quarterly publication was not adopted until the commencement of the eighth volume. William Tudor edited it for two years, and in 1817 it passed under the control of a club. Jared Sparks (q.v.) was chief editor for one year, when the duty was undertaken by Channing, aided by his cousin, Richard Henry Dana (q.v.). In October 1819, Channing was succeeded in the editorship of the *Review* by Edward Everett, having been appointed Boylston professor of rhetoric and oratory in Harvard University. This post he held for 32 years, resigning it in 1851. During all this

time, the department of rhetoric and oratory, including the charge of all the English compositions of the students which had great influence over their reading and taste, was filled by him with more than satisfaction to the public of reading and thinking men. A volume of his letters was published in 1856 with a memoir by R. H. Dana.

CHANNING, William Ellery, American Unitarian clergyman: b. Newport, R. I., 7 April 1780; d. Bennington, Vt., 2 Oct. 1842. Entering Harvard College at 14 he took his degree in 1798 and though at first inclining to the study of medicine, presently decided upon the profession of the ministry. After his graduation he spent two years in Virginia as a tutor, but in pursuance of his ascetic views regarding renunciation and the necessity of subduing the animal nature, he endeavored to accustom himself to hardships during this period, even denying himself sufficiency of food and clothing. The result of this unwise course was to implant in him the tendency to disease that made him for the greater part of his career a semi-invalid. Returning from Virginia he took up the study of theology, making at the start a careful study of the evidences of Christianity, wishing, as he said, to know what Christ taught and not what men made him teach. In 1801 he was made regent of Harvard, the duties of this office being light and the salary sufficient for his support while continuing his studies. In 1802 he preached his first sermon at Medford, Mass., from the text "Silver and gold have I none; but such as I have, give I thee." In 1803 he was ordained pastor of the Federal Street Church in Boston and continued in that relation for the rest of his life. In the earlier years of his ministry the denominational spirit was not especially strong in him and with the ministers of the Trinitarian churches in Boston, he was on most friendly terms. His opinions were ripening during this period, however, and in 1819, at the ordination of Rev. Jared Sparks in Baltimore, he preached a sermon in which for the first time he gave free expression to the principles of Unitarian Christianity, upholding the exercise of reason in religious matters; declaring the Bible to be "a book written for men in the language of men and its meaning to be sought in the same manner as that of other books." He also objected to the doctrine of the Trinity, affirming his belief that Christ was distinct from and inferior to God, and sent to men as a great moral teacher, not as a mediator between erring man and offended deity. This discourse gave rise to much controversy and fixed definitely the Unitarian position as distinguished from that of the Trinitarians. It made him, moreover, the recognized leader of American Unitarianism, and much as he disliked controversy he never hesitated from uttering what he believed to be true because of hostile criticism. His greatest dread was of becoming creed-bound and thus losing perception of new truths, and he even spoke of himself as "little of a Unitarian," and standing aloof "from all but those who strive and pray for clear light, for a purer and more effectual manifestation of Christian truth." After 1824 Rev. Ezra Stiles Gannett was associated with him in the ministry of the Federal Street parish and from this epoch his time was largely

given to philanthropic and literary work, the asceticism of his youth having long since been supplanted by a more wholesome understanding of life and its requirements and duties. He visited Europe in 1822 and became acquainted with Coleridge and Wordsworth. He was one of the first to acknowledge the greatness of the latter, and save Shakespeare, he read no poet oftener. Channing was a fearless defender of freedom and upheld Garrison when that great abolitionist was the most generally detested person in Boston. In the pulpit his mission, as he saw it, was to free men's minds from servile conceptions of God, to disabuse religion of its benumbing terrors and to show forth to men the real significance of their moral natures. His writings on theological, social and philanthropic themes have received the widest circulation and been translated into French, Italian, German, Icelandic, Russian and Hungarian. The most notable of them include 'Evidences of Revealed Religion'; 'Essay on National Literature' (1823); 'Remarks on the Character and Writings of John Milton' (1826); 'Character and Writings of Fénelon' (1829); 'The Duty of the Free States' (1835); 'Negro Slavery' (1835); 'Self Culture' (1838). He had a life-long abhorrence of slavery, but in his 'Duty of the Free States' his feelings on the subject find fullest expression. His name, moreover, was associated with the most of the social reforms of his day and besides bearing a part in the great anti-slavery agitation, he warmly sympathized in the temperance movement, was an ardent lover of peace and deeply interested in schemes for educational advance. He stood for intellectual and spiritual ideas and foresaw dangers both to nations and individuals in the spread of materialism, in the contented adoption of inadequate aims, complacent satisfaction with perishable interests. In an age when comparatively few religious leaders dared to think outside of narrow prescribed limits, Channing stood forth as the intellectual champion of freedom. Much of his influence may have been due, no doubt, to the singular sweetness of his disposition and his entire nobility of character, but more of it was due to the fact that he spoke with utter fearlessness and thus inspired other men to free themselves from the fetters of dogma or of intellectual timidity. Although two generations have passed since his death, his name is still both familiar and beloved and his beneficent influence, far from lessening its hold upon men, has deepened and widened with the years. Channing's literary style, while not highly ornamental, was both clear and vigorous and his sentences were usually short and direct, though it is said that his personal preferences in the writings of others were for long and involved sentences. On 1 June 1903, a bronze statue of Channing by Herbert Adams was unveiled in the public garden in Boston, Mass., its site being opposite the Arlington Street Church, the successor of the Federal Street Church, of which he was so long pastor. The statue and its monumental setting were the gift of John Foster to the city. Consult 'Lives' by W. H. Channing and C. T. Brooks (3 vols., London 1848, and reprinted Boston 1880); 'Correspondence of Channing and Lucy Aiken'; Peabody, 'Reminiscences'; Chadwick, 'W. E. Channing' (Boston 1903).

and Eliot, *Four American Leaders* (Boston 1906).

CHANNING, William Ellery, American poet, nephew of William Ellery Channing, the elder: b. Boston, Mass., June 10, 1818; d. Concord, Mass., Dec. 23, 1901. After some years spent in newspaper work he retired to Concord, where he lived the life of a recluse. His writings include *Poems* (1843-47); *The Woodman* (1849); *Near Home* (1858); *The Wanderer* (1871); *Thoreau, the Poet-Naturalist* (1873); *Eliot* (1885); and *John Brown and the Heroes of Harper's Ferry* (1886).

CHANSONS DE GESTE, shān-sōn'dē zhěst', epic poems of the Middle Ages. Gaston Paris (1839-1903), one of the great authorities on French medieval poetry, has defined the *chanson de geste* as a song of which the subject is a series of historical facts. One might also describe it as an historical romance in poetic form. The French word *geste* (deriving from the Latin *gesta*) means fact, deed, also feat; and indeed these songs, the prime poetic achievement of France between the 11th and 13th centuries, deal mainly with historic and fabulous feats of arms. The most famous of them, the *Chanson de Roland* (q.v.), a poem in 10-syllable lines, is the earliest, its composition dating from the latter half of the 11th century. The anonymous author is believed to have lived at or near Mont Saint-Michel in Normandy at the time of the conquest of England; but that he was one of Duke William's vassals in that exploit is a mere conjecture. There is evidence that the *Roland* was written after 1066 but before the First Crusade (1096-1099). Roland, one of Charlemagne's paladins, fell in the valley of Roncesvaux on August 15, 778, heroically defending the rear guard of the emperor's army retreating out of Spain against Basque onslaughts. This disastrous battle in the Pyrenees occurred three centuries before the epic narrative was penned on parchment by an 11th century poet, and by that time the hero had already become a legendary figure. The glorification of a warrior of an epoch long past is characteristic of the *chansons de geste*.

Sung by the *trouvères* these poems are essentially masculine and northern in spirit, differing in form, theme, and spirit from the lyric poetry which the *troubadours* were producing in the same period in the more imaginative, complex and advanced civilization of Provence. They were composed mainly for male auditors in a region of France and at an epoch when the military tradition was dominant, the qualities of the knight at arms held in highest esteem and when prowess in battle was accounted the supreme male virtue. The troubadour poetry, on the other hand, was for feminine listeners and readers, to charm them with tales of tender love and eternal devotion. The southern poets were far more interested in the joy of life and love than in the rude shock of battle and a hero's death. Often they dedicated their verses to the queens of the little kingdoms who were their generous patrons.

A salient characteristic of the northern epics is their deep religious and national feeling. With the exception of the *Roland*, however, these poems, mostly by unknown authors, reveal only a rudimentary knowledge of literary con-

struction. As a rule, the narrative is rambling and diffuse; the versification is rough; the characters lack shading, being all white or all black; and moral problems are all but nonexistent. Yet despite these many defects they express an undeniable primitive force and sincerity as well as profound religious sentiment. Above all they express an intense love of the native soil, a noble patriotism unexcelled in the poetry of more civilized epochs. They were, undoubtedly, largely influential in fostering the spirit of Christian chivalry that flowered during the Crusades.

Epic Poetry and the Chansons de Geste.

—Leon Gautier (1832-1897), the foremost authority on the *chansons de geste*, points out that of the three kinds of poetry—lyric, epic and dramatic—historically the epic is of more recent growth than the lyric, while dramatic poetry developed last of all. He makes a distinction between kinds of epic poetry, dividing the category into "natural" and "artificial" epics. The prime characteristic of the natural epic is its legendary quality. Like the Homeric poetry it is the cradle song of a people in the infancy of their civilization. All natural epics are songs of the people. Artificial epics, on the other hand, belong to a later stage of civilization, and have been written for cultivated tastes. As examples of the natural epic Gautier cites the *Iliad* and the *Chanson de Roland*; while to the class of the artificial he assigns Virgil's *Aeneid*, Tasso's *Jerusalem Delivered* and Voltaire's *Henriade*, the only notable modern French epic.

The natural epic, again according to Gautier, requires four conditioning circumstances: (1) A primitive period when science and criticism are virtually nonexistent, when history and legend are easily confounded, and credulity is general. (2) A national and religious environment that has developed in a country which has achieved a measure of national unity, as was the case in France when the *chanson de geste* was, in effect, the great war cry of Christianity against Islamic invasion; and when religious and patriotic concepts are difficult to distinguish. (3) Extraordinary and grievous events. Tragedy is the prime element of the epic. A defeat and a heroic death are the subjects of most of these virile songs, replete with blood and tears and almost devoid of the emotion of joy. With grief there is room only for saintliness: the central figures of the three major cycles are St. Charlemagne, St. William and St. Renaud. (4) Heroes who are the personification of an entire nation in an historical epoch. Just as Achilles personified the Greek race at a certain stage of its history, so Roland represents the chivalrous France of the 10th and 11th centuries.

To sum up these essentials of the natural epic: a primitive epoch for its creation; a national and religious environment; extraordinary and tragic events; and, finally, a hero who is the personification of an entire country and an historical epoch.

The Cycles.—A cycle in the meaning of the term as applied to epic poetry may be defined as a group of poets and poems dealing with an event, a hero, or a notable family. The central figures of the three major French cycles are Charlemagne, Duke William Shortnose and Renaud de Montauban. The Charlemagne cycle, most famous of all, is called *La Geste du Roi*;

that of Duke William, *La Geste de Guillaume*, or, alternately, *La Geste de Garin de Montglane*; that of Renaud, *La Geste de Doon de Maïence*. This division of the earliest epics into three main groups owes nothing to the researches of modern paleographers; it was recognized by the trouvères themselves and explicitly stated in one of the chansons, *Girars de Viane*.

Gautier has divided the Charlemagne cycle into six subdivisions, the first of which deals with Charlemagne's mother, Bertha, and the personal life of the emperor himself until the appearance of Roland. To this group belong *Bertha Greatfoot* (*Berte aus grans piés*) and *Aspremont*, describing a fictitious campaign against a Saracen king in Calabria. The second group, known as the feudal epic, describes the emperor's struggles with rebellious vassals: it includes *Ogier the Dane*. In the third group are the poems describing Charlemagne and his peers on a quite legendary trip to the Holy Land. The best known of this group, the *Pilgrimage to Jerusalem*, affords the first example of Alexandrine verse (the 12-syllable line) used by a French poet. A fourth group deals with events before the Spanish war: it includes *Aiquin*, *Fierabras* and *Otinél*. The fifth concerns the war in Spain and includes the *Chanson de Roland*. The sixth and last treats with events after Roland's death to the death of Charlemagne in 814.

The *Geste de Guillaume* chansons of the 12th century include *Le Charroi de Nîmes*, *La Prise d'Orange* and *Le Moniage Guillaume*. They celebrate the duke's battles with the Saracens or with rebellious vassals of his suzerain, Louis the Debonnaire, Charlemagne's son. The *Moniage* abounds in heroicomic episodes, describing the duke's conversion to a holy life, his last exploits, retirement to a monastery, and issuing from it to deliver Paris from besieging Saracens (a fabulous event). Later the poets wrote of the hero's boyhood (*Enfances Guillaume*), his ancestors and his nephews. The 13th century poets were prolific narrators of youthful exploits of popular heroes. Thus they produced "enfances" of Charlemagne and Ogier the Dane, of Roland and Vivien (nephew of Duke William and the prototype of the young Christian hero who fights and dies for his faith). Even heroes of a more recent epoch, like the crusader Godfrey of Bouillon, king of Jerusalem, were thus honored. William, educated in Charlemagne's palace school at Aix-la-Chapelle, may have been a relative of the emperor. Historically we know little about him. In 792 his army was defeated by a Saracen horde of 100,000, but fought so valiantly that the invaders were forced to retire out of France. In 801 he captured Barcelona from the Saracens, and five years later retired to Gellone near Lodève (Hérault) where he founded a monastery of which he was abbot until his death in 812. After his canonization the monastery was named Saint-Guilhem-du-Désert.

La Geste de Doon de Maïence, third cycle of the Charlemagne romances, deals with revolts against Charlemagne of members of the family of the archtraitor Ganelon who betrayed Roland to his death at Roncesvaux; wherefore it is sometimes called "*la faulse geste*." It includes some of the most famous chansons, such as *Parise la Duchesse*. The *Four Sons of Aymon* and *Huon de Bordeaux*. Doon of Mayence (i.e.,

Mainz, near the confluence of the Rhine and the Main) is represented as the father and grandfather of revolting barons. He had twelve sons, one of whom was the father of Ogier the Dane, another of Ganelon, and a third of Huon. Renaud of Montauban, one of the four sons of Aymon, is the principal figure in this cycle. After enduring fearful sufferings and exile he at last makes his peace with Charlemagne. Although the authors of these chansons strove to achieve a kind of unity by providing a common ancestor for their heroes, they were not at all troubled over implausibilities and manifest anachronisms. There was a misty tradition of a traitorous family in Mayence, but the exploits of the barons of the chansons, if they have any basis of fact must have occurred either before or after Charlemagne's time. These vassals' contemptuous and insolent attitude toward the Emperor of the West who ruled half of Europe was certainly not that of the very few who dared challenge that supremely powerful monarch. However, their scorn of the suzerain may well have reflected attitudes toward the earlier Frankish kings and the weaker Carolingian sovereigns who succeeded Charlemagne.

Minor Cycles.—There are seven or eight secondary cycles. In the ancient eastern Gallic kingdom of Austrasia, cradle of the Carolingian dynasty, the sanguinary and savage chansons of the Lorrainers developed. These epics constituted a cycle of hatred and private wars of vengeance, making it preeminently the feudal cycle. The cycle of Raoul of Cambrai originated in Vermandois. There were also those of Aubri the Burgundian and Elie of St. Gilles. Later a malady which Gautier ironically calls "cyclic monomania" afflicted the poets and they attempted to establish family relationships between the heroes of these minor cycles and those of the three major.

The last cycle was that of the Crusaders. Godfrey of Bouillon (1061-1100) and Peter the Hermit were its leading figures. Actually, the spirit of the Crusades animated all the cycles, and hardly had the first French king of Jerusalem died than the age of the great epics ended. Commencing with Charlemagne and ending three centuries later with Godfrey, the great epic cycles closed with a fitting celebration of the noblest representative of chivalry of his day.

Manuscripts of hundreds of chansons de geste are preserved in French archives. Many of them have never been published, and most of these would doubtless be interesting only to students. But the influence of the epics of the major cycles permeates all of Western literature. Oberon, king of the fairies, one of the characters in *Huon de Bordeaux*, was borrowed by Spenser and Shakespeare. Dante, Tasso and Ariosto owed a debt to these martial poems of medieval France. Indeed, every poet of later ages who attempted the epic found in them a source of inspiration. As Shakespeare, better than any other author, expresses the English spirit, so the chansons de geste portray the indomitable spirit of France.

Bibliography.—Paris, Paulin, *Les Chansons de Geste: poèmes du 12^e et du 13^e siècle* (Paris 1859); Paris, Gaston, *Histoire poétique de Charlemagne* (Paris 1865); Meyer, Paul, *Recherches sur l'épopée française* (Paris 1867); Gautier, Léon, *Les Épopées françaises*, 2d ed., 4 vols. (Paris 1878-92); Longnon, A., *Les Quatre Fils Aymon* (Paris 1879); Paris, Gaston, *La Littérature française au moyen âge* (Paris 1890); Pope, Mildred K., "Four Chansons de geste: a study in old French versification" in

Modern Language Review, vols. 8, 9, 10 (London 1913-14).

DRAKE DE KAY,

Editorial staff, "Encyclopedia Americana."

CHANT, a short musical composition adapted to the singing of the psalms and canticles. Chants are single when adapted to a single verse, and double when adapted to two verses, the former consisting of two strains of three and four bars respectively, and the latter being twice that length. More recently quadruple chants extending over four verses have been introduced. The complete chant consists of four parts, namely: (1) The intonation or initial phrase leading up to the reciting note; (2) the reciting note, which is the dominant of the mode employed; (3) the mediation, or main body of the chant; and (4) the termination or concluding phrase. In modern Anglican chants, however, there is no intonation. The origin of the plain song of the Church is unknown, but the first attempt to reduce the traditional music to some definite system was made by Saint Ambrose, bishop of Milan (d. 397). More important, however, by far is the Antiphonarium of Gregory the Great, which appeared in the latter half of the 6th century and soon established itself as the chief and in fact only authority on Church music. The Gregorian tones were introduced into England by Saint Augustine, and in the course of their history in that country they underwent many modifications in the various local "uses." During the civil war and the Commonwealth they went out of use, but were revived at the Restoration. Not long afterward, however, the Gregorian chants began to give place to the modern double chants, and it is only in quite recent years that attempts have been made to revive them. A new impetus has been given to the use and popularization of plain chant in recent times by the first encyclical letter of Pius X, his "*motu proprio*" and the introduction of Gregorian music in all the Catholic churches throughout the world. See also GREGORIAN CHANT.

CHANT DU DEPART, shān dü dā-pār (Fr. "Song of Departure"), a popular French military song of the period of the Revolution, written by the poet Marie Joseph Chenier, to the music of Méhul. The occasion for its composition was the celebration of the fifth anniversary of the taking of the Bastille.

CHANT ROYAL, a verse form invented by medieval French poets. Some students consider it a development of the ballade (q.v.), but it is a matter of conjecture as to which form preceded the other. It can be roughly defined as a ballade of five stanzas, each consisting of eleven lines, with a five-line envoi. The first stanza contains five rhymes which are used in the same order throughout, but only two rhymes are used in the envoi; the sixty lines of the poem consequently have only these five rhymes. As in the ballade the last line of the first stanza becomes a refrain, repeated at the end of each following stanza and the envoi. The rhyme scheme for the stanzas is *a b a b c c d d e d e*, and for the envoi, *d d e d e*.

Edmund W. Gosse (q.v.) who wrote one of the few English examples (indeed, he was the

first poet to compose in this form in English) states that "the chant royal is the final *tour-de-force*, the *ne plus ultra* of legitimate difficulty in the construction of a poem. Henri de Croi [in *Ari et science de rhétorique* (1493)] derives the title from the fact that persons excelling in the composition of *chants royaux* were worthy to be crowned with garlands like conquerors or kings." Gosse adds that the chant royal "was always dedicated to more stately and heroic themes than the ballade. The chant royal was reserved for the celebration of divine mysteries, or for the exploits of some heroic race." The most admirable are those of Clément Marot (q.v.), the protégé of Francis I who shared his sovereign's disaster at Pavia (1525) when all was lost *hors l'honneur*. The *Chant Royal, Chrestien* was Marot's most noted achievement in this form. Its refrain, "*Santé au corps, et Paradis à l'âme*, expresses the Christian's longing for physical health and happiness on earth and the soul's salvation hereafter—a contradictory aspiration, warns the poet, since Christ has promised his followers in their earthly existence only trouble, pain and sorrow.

Eustache Deschamps (1340-1410) describes a variant popular in the Middle Ages, in praise of the Virgin Mary. These Marist chants royaux differ only in lacking the envoi.

Jean de la Fontaine (q.v.) was the last of the classicists who attempted a supremely difficult form. Only toward the end of the 19th century with the revival of interest in antique verse forms—ballade, rondel, rondeau, villanelle, triolet—did French and English poets seek to revive it. Gosse's *The Praise of Dionysus* (1877) and *Death of Death* by Henry Austin Dobson (q.v.) follow the classic form and spirit.

Henry Cuyler Bunner (1855-1896), American poet, wrote what is probably the only comic chant royal by a poet of high technical ability. Two of the stanzas and the envoi will suffice to exemplify the structure and rhyme arrangement adapted to a mock heroic theme

BEHOLD THE DEEDS!

(Being the Complaint of Adolphe Culpepper Ferguson, Salesman of Fancy Notions, held in durance of his Landlady for a failure to connect on Saturday night.)

I.

I would that all men my hard case might know;
How grievously I suffer for no sin:
I, Adolphe Culpepper Ferguson, for lo!
I of my landlady am locked in,
For being short on this sad Saturday,
Not having shekels of silver wherewith to pay:
She has turned and is departed with my key:
Wherefore, not even as other boarders free,
I sing (as prisoners to their dongeon-stones
When for ten days they expiate a spree):
Behold the deeds that are done of Mrs. Jones!

V.

Thou, for whose fear the figurative crow
I eat, accused be thou and all thy kin!
Thee will I show up—yea, up will I show
Thy too thick buckwheats, and thy tea too thin.
Ay! here I dare thee, ready for the fray;
Thou dost not "keep a first-class house," I say!
It does not with the advertisements agree.
Thou lodgest a Briton with a puggaree,
And thou hast harbored Jacobes and Cohns,
Also a Mulligan. Thus denounce I thee!
Behold the deeds that are done of Mrs. Jones!

Envoy.

Boarders! the worst I have not told to ye:
She hath stolen my trowers, that I may not flee
Privily by the window. Hence these groans.
There is no fleeing in a robe de nuit.
Behold the deeds that are done of Mrs. Jones!

Consult Murray, M. W., and Casati, E., *Four Centuries of French Poetry* (London 1935).

CHANTABON or **CHANTABUN** or **CHANTIBUN**. See **CHANTHABURI**.

CHANTADA, chān-tā'thā, town, Spain, in Lugo Province, is located 20 miles northeast of Orense, on the Chantada River, a branch of the Miño, in an agricultural area producing livestock, grain, flax, and potatoes. Its industries are tanning, ham processing, and linen manufacture. It also has mineral springs. An old Roman bridge crosses the Miño about three miles east of the town. Pop. (1940) 1,552.

CHANTAL, shān-tāl', **BARONNE DE** (née **JEANNE FRANÇOISE FRÉMIOT**; later known as **SAINTÉ CHANTAL**; also **ST. JANE FRANCES DE CHANTAL**), French religious: b. Dijon, France, Jan. 28, 1572; d. Moulins, Dec. 13, 1641. After the death of her husband, Celse de Rabutin, baron de Chantal, in 1601, she devoted her life to charity; and in 1610, assisted by St. Francis de Sales, she founded the Congregation of the Visitation of Our Lady, at Annecy. (See **ORDERS, RELIGIOUS**—*Visitation Nuns*.) She was superior of its house in Paris (1618-1622). Beatified in 1751 and canonized in 1767, her feast day is August 21.

CHANTAVOINE, shān-tā-vwān', **Henri**, French poet and historian: b. Montpellier, France, Aug. 6, 1850; d. Caluire (Rhône), Aug. 15, 1918. He was educated at the École Normale, Paris, and became professor of rhetoric at the Lycée Henri IV. He contributed to the *Nouvelle Revue* from its founding in 1879, and in 1884 joined the *Journal des Débats*. His published volumes of poems include *Poèmes sincères* (1877); *Satires contemporaines* (1880); *Ad memoriam* (1884); *Au fil des jours* (1889). His historical works include *Histoire de Pinchu* (1906); *Les Principes de 1789* (1908).

His son, **JEAN CHANTAVOINE** (b. Paris, May 17, 1877; d. Mussy-sur-Seine, July 16, 1952) was music critic of *Revue Hebdomadaire* (1903-1920); also of *Excelsior*, of *Ménestrel*, and other publications (1911-1921); general secretary of the Paris Conservatoire from 1923. He recovered the score of Franz Liszt's lost opera *Don Sancho* which he describes in his *Musiciens et Poètes* (1912). He is also the author of *Beethoven* (1906); *Liszt* (1910); *De Couperin à Debussy* (1921); *Les symphonies de Beethoven* (1932).

CHANTECLER, shān-t'klār'. The most original play of the French poet and playwright Edmond Rostand, although by no means his best, is *Chantecler*, produced in Paris in 1910. The public, which had first been captivated by the dashing *Cyrano de Bergerac*, and then charmed by the more ambitious *L'Aiglon*, had for a decade yearned for another piece from the poet's pen. When it came, after judicious heralding, it proved, to many, something of a disappointment. A *tour de force*, brilliant, witty, and novel, it was nevertheless seen to stand apart from the main development of the modern drama. Rostand, as a romanticist, had sought to clothe with unconventional garb figures to be used in a satire. From his observation of barnyard animals he caught the notion of presenting contemporary society in hide and feathers. Accordingly, he offered a

dramatic fable, its central theme the faith of Chantecler, the cock, in his mission as the bringer of the dawn.

Chantecler believes that his joyous song directly evokes the sunrise. Great is his distress to find, when the envious hen pheasant has screened his eyes with her wing and made him forget his task, that the dawn has brightened without him and that he and his work are of little moment in the scheme of creation. Yet he will leave the forest, whither the hen pheasant has beguiled him, and return to his barnyard to proclaim, though he cannot produce, the day. His companion, freshly enthralled by this evidence of his courage in defeat, flies up to protect him by diverting to herself the attention of a hunter, but, caught in a snare, she dies. Incidentally, the play laughs at the social climbers who attend the guinea fowl's five o'clock tea, at the cynical blackbird, the fancy cocks who are fops and faddists, and the spiteful birds of night. More sympathetic are the hero, Patou the dog, a good old idealist, and the hen pheasant, who represents woman the enchantress, piqued by man's devotion to his work, yet ready to lay down her life for him.

The style of this fantasy is a marvelous mixture of poetry and slang, witty quips and smart local allusions jostling passages of lyrical beauty. No translator could hope to render its rich and poetic quality, although the English versions of Gertrude Hall (1910) and J. S. Newberry (1911) are worthy attempts toward this end. M. F. Liberma has written a critical analysis of the play entitled *The Story of Chantecler* (1910).

FRANK W. CHANDLER.

CHANTERELLE, shān-tē-rēl', a small edible mushroom (*Cantharellus cibarius*), yellow to orange in color, rather unsymmetrical in form growing in woods. See also **MUSHROOM**.

CHANTEY, shān'ti; chán'ti (also **CHANTE SHANTEY**, or **SHANTY**), a song of English and American sailors, generally sung to accompany group tasks associated with sailing vessels. Some chanties set the rhythm for reefing the sail, some for pumping, others for hoisting anchor. Among the most famous are *Mobile Bay*; *The Banks of the Sacramento*; *The Rio Grande*.

Consult Concord, J. C., *Songs of American Sailors* rev. ed. (New York 1938).

CHANTHABURI, chān-t'hā-bōō-rē, **CHANTABURI** (also **CHANTABUN**, chān-t'hā-bōōn), town, Thailand, capital of Chanthaburi Province, is located about 135 miles southeast of Bangkok, on the Chanthaburi River, near the Gulf of Siam. It has a deepwater port called Laem Sing. The surrounding area raises rice, pepper, coffee, and kapok; there are fisheries and a handicraft industry. Semiprecious stones are mined in the region. The population is largely Annamese and Cambodian. Originally a part of the Khmer Empire, the town passed to Thailand in 1576. Occupied by the French in 1893-1894, it was called Chantabon. Pop. (1947) province 110,808; town, 6,711.

CHANTILLY, shān-tē-yē', town, France, Oise Department, about 25 miles northeast of Paris, is a racing center and favorite Paris resort. Its industries are sawmilling and the manufacture of porcelain. It also ships mushrooms. The manufacture of Chantilly lace, for which it is formerly known, has declined. Chantilly has

tiful châteaux, the smaller of which is re-
lated as one of the finest specimens of French
renaissance architecture. The larger château
built for Louis II, prince de Condé, (1621-
55), called the great Condé who entertained
the most brilliant men of the time, in-
cluding La Fontaine, Racine, Molière, Boileau,
La Bruyère, and La Fontaine. This château was
destroyed during the French Revolution, but an-
other was built on its site by Henri d'Orléans,
duc d'Aumale, heir of the last Condé, and was
presented by him with its grounds, gardens, for-
tification, library, and art collection to the Institut de
France in 1886. The town was the general head-
quarters of the French Army in World War I.
N. (1946) 6,040.

CHANTILLY, shàn'til-ī, or **OX HILL**,
site of. On Aug. 31, 1862, the day after the
second Battle of Bull Run, Gen. Robert E. Lee
marched his army by way of Sudley Ford around
the John Pope's right at Centreville, Va., to
the Fairfax Court House and interpose between
him and Washington, D.C. Gen. Stonewall
Jackson was six miles west of Chantilly; Gen.
James Longstreet some distance in the rear.
Next morning, September 1, Jackson moved cau-
tiously toward Fairfax Court House and formed
on Ox Hill ridge, three miles east of Chan-
tilly, his artillery massed on the left of the road,
infantry on the right, extending in the direc-
tion of the Centreville road. He had not com-
pleted his formation when he became aware of
an approaching force from the Centreville road,
whereupon he strengthened his right and threw
off skirmishers.

About 1 P.M., Pope, who had heard of Jack-
son's advance toward his rear, sent Gen. Isaac I.
Stevens with about 3,000 men to gain the road
at Chantilly and to hold Jackson in check
until the Union Army could be brought into posi-
tion at Fairfax Court House. Stevens struck
Jackson's advancing skirmish line and drove it
back into a body of woods. Jackson then ad-
vanced a regiment from the woods, which also
was repulsed. Stevens next formed a column of
infantry (six regiments in three lines, two each
a line), placed himself in the center of this
column of 2,000 men, on open ground, and or-
dered it forward as the woods in front were
cleared.

The advancing column, ascending a gentle
slope, came to within 75 yards of the woods, when
a worm fence bordering them came a ter-
rible volley hitting the column with great effect,
falling by the score. At first the column
halted, but, quickly recovering, returned the
fire, five color bearers of the 79th New York
Infantry's old regiment, went down in succession.
The assault was checked. Stevens ran forward,
urged the colors, and called upon his men to
follow him. All rushed forward and gained the
position on which Stevens fell dead with a bullet
through his brain and the colors upon his head
and shoulders. The column advanced into the
woods.

At the moment that they reached the
woods a sudden and terrific thunderstorm and
burst over the field, blowing rain into the
faces of the men, impeding their movements, and
depleting their ammunition. Jackson brought up
his reserves, and after a contest of more than an
hour the six Union regiments were driven out
of the woods and fell back to the point where they
were formed.

Meanwhile three regiments of Gen. Jesse Lee
Reno's command had been committed on Stevens'
right, one only of which, the 21st Massachusetts,
became seriously engaged and was repulsed with
great loss. Gen. Philip Kearny now came up
with a battery, which he put in position, and went
to the right for a regiment to fill an interval.
He met the 21st Massachusetts as it came from
the woods and was leading it to the left, when
his attention was called to the fact that the
Confederates were advancing from the woods and
through a cornfield. He spurred his horse into
the cornfield to reconnoiter, ran upon a skirmish
line, saw his mistake, and turned to ride back,
when he was shot and killed. A sharp encounter,
ensuing between the 21st Massachusetts and the
Confederates, was ended by darkness: the regi-
ment withdrew, the Confederates retired to the
woods, and the battle was ended, neither side hav-
ing permanently gained a foot of ground. Pope
fell back to Washington, and Lee marched to
cross the Potomac into Maryland. The Union
loss was about 800 men; that of the Confederates
about 700.

E. A. CARMAN.

CHANTREY, chàn'trī, **SIR FRANCIS LEGATT**,
English sculptor: b. Jordanthorpe, Derbyshire,
England, April 7, 1781; d. London, Nov. 25, 1841.
He was the son of a carpenter and small farmer,
and at first worked for a grocer in the nearby
town of Sheffield. While there he noticed some
work in the window of a carver and gilder named
Ramsay and in 1797 became apprenticed to him
for seven years. J. Raphael Smith, a mezzotint
engraver, perceiving Chantrey's talent for draw-
ing and modeling, encouraged him. He received
his first instruction in oil painting from Samuel
James. By 1802 he was in London, studying at
the Royal Academy. His first commission was in
1805 from the people of Sheffield for a memorial
bust of the Reverend J. Wilkinson, to be placed
in the parish church. He exhibited regularly at
the Royal Academy and in 1808 was the suc-
cessful candidate for a statue of George III for
the Guildhall in London. Subsequently he exe-
cuted busts of a number of distinguished sitters,
including George IV, Sir Walter Scott, the duke
of Wellington, and the poet William Wordsworth.
In 1815 Chantrey was chosen an associate and
in 1818 a member of the Royal Academy. In
1819 he visited Italy to study in the galleries.
While there, he was elected member of the acad-
emies of Rome and Florence. He was knighted in
1835.

His most celebrated work is the *Sleeping
Children*, a monument erected to two children
of the Reverend W. Robinson, in Lichfield Cath-
edral. He left a fortune of about £150,000, which,
after the death of his widow, became the Chantrey
bequest to the Royal Academy for the annual
purchase of works of sculpture and painting exe-
cuted in Great Britain by living or recently de-
ceased artists.

CHANTRY, chàn'trī (Old Fr. *chanterie*), an
ecclesiastical endowment to provide for the cele-
bration of masses for the prosperity of the living
or the repose of the dead. Before the Reforma-
tion chantries were numerous, almost every family
of importance having founded one or more. Some-
times small chapels were appended to the main ed-
ifice of a church, and occasionally, as at Wakefield
and Bradford on Avon, in England, such chapels

were erected on bridges. The residences of priests engaged in the services were known as chantry houses, chantries, or colleges. The chantry schools were widely spread over England prior to the Reformation. Chantries were finally dissolved in England by Edward VI, and nearly all endowments were devoted to the purposes of the crown.

CHANUTE, shā-nōōt', city, Kansas, in Neosho County, at an altitude of 940 feet, on the Neosho River, 69 miles southeast of Emporia, and served by the Atchison, Topeka and Santa Fe and the Missouri, Kansas and Texas railroads and a municipal airport named after Martin Johnson, the explorer. Surrounding the city is an area of diversified farming, with extensive deposits of gas, oil, limestone, and clay. Chanute has railroad shops, a wax plant, oil refineries, and factories that produce oil tanks, brooms, men's work clothing, gas mantles, and cement. The city has several parks, a public library, a good public school system including a junior college, and an imposing municipal memorial building.

Settled in 1868, Chanute was incorporated in 1872. It was named in honor of Octave Chanute (1832-1910), railroad civil engineer and one of the pioneers of American aviation. In 1912 the city adopted commission form of government. Its water supply system, and the light, natural gas, and power systems, are municipally owned. In 1930 city tax levies were eliminated, cost of administration being covered by profits of the municipal utilities. Pop. (1940) 10,142; (1950) 10,109.

CHANZY, shān-zē', Antoine Eugène Alfred, French general and politician: b. Nouart, Ardennes, March 18, 1823; d. Châlons-sur-Marne, Jan. 4, 1883. After a course at the military school of Saint-Cyr, he became sub-lieutenant of infantry in 1843, and was sent to Algeria and eventually became major. He subsequently served in Italy and Syria, but on becoming colonel he returned to Africa in 1868. On the outbreak of the war with Germany in 1870 he was created a general of division, and after gaining the battles of Coulmiers and Patay, was put in command of the second army of the Loire. Here he fought heroically against the much stronger and more disciplined Germans, but finally had to retreat. He was elected to the National Assembly for the department of Ardennes, and during the Commune he narrowly escaped with his life. When peace was declared he was elected to the National Assembly and became in 1872 commander of the Seventh Army Corps. In 1873 he went to Algeria as governor, in 1875 was elected life senator and in 1879 he stood for the presidency. In that year also he was sent to Russia as ambassador, a post which he held until 1881, when he became commander of the Sixth Army Corps. He published *La deuxième armée de la Loire* (1871).

CHAOAN, chou'an', or **CHAOCHOW**, city, China, in the province of Kwangtung, on the river Han, 195 miles northeast of Hongkong. It is the center of an important maritime division of the province. The channel leading to it is very shallow, so that ships of large burden can sail up only at high water. This city was included in the Treaty of Tientsin (1858) as a port open

to foreign trade, but the foreign trade is transacted at Swatow. Pop. (1948 est.) 59,486; Chaoan county 620,785.

CHAOS, kā'ōs, according to the signification of the word, the void which embraces all things. Hesiod mentions, as the original principles of all things, Chaos, Earth, and Eros (Love); other ancient poets made Chaos alone the primeval source from which everything is derived; others added to it Night, Erebus, and Tartarus; and still others represented Chaos as the parent of the Earth and Heaven, after the production of which Eros completed the creation. Modern writers commonly understand by chaos the uniform primeval matter from which the universe was made. The word chaos is also used to denote utter confusion or disorder.

CHAPPAIS, shā-pē', Sir Thomas, Canadian journalist and statesman: b. Saint Denis, Quebec, March 23, 1858; d. there, July 15, 1946. He was graduated at Laval University in 1879 and was called to the bar in the same year. From 1879 to 1884 he was private secretary to the lieutenant governor of Quebec and from 1884 to 1901 edited *Le Courier du Canada* (Quebec). He became a member of the legislative council in 1892 and was made speaker in 1895. In 1893 he was a member of Sir Louis O. Taillon's cabinet and in 1897 was minister of colonization and mines. In the latter year he retired from public life and was appointed (1907) professor of history at Laval University. He was made chevalier of the Legion of Honor in 1902. His published works include *Les congregations enseignantes et le brevet de capacité* (1893); *Le serment du roi* (1901); *Jean Talon, intendant de la Nouvelle France* (1904); *Le marquis de Montcalm* (1911); *Cours d'histoire du Canada*, 8 vols. (1919-1934); *Discours et conférences* (1897-1935).

CHAPALA, chā-pā'lā, lake, Mexico, on the high plateau of Jalisco, surrounded by steep bare mountains. It has an estimated area of 417 square miles and contains many islands. The Rio Lerma is its chief tributary stream, entering from the east; its outlet is the Río Grande de Santiago.

CHAPARRAL-COCK. See ROAD-RUNNER.

CHAPBOOKS, a species of cheap literature, in the form of small pamphlets, which preceded the popular periodicals of the present day and were so called because prepared expressly for sale by the chapmen, or pedlars, who hawked them from district to district. They were largely productions of the provincial presses. The writers are mostly unknown, but one of the authors of Scottish chapbooks was Dougal Graham (1724-1779), bellman of Glasgow. Their matter was of the most varied character, including theological tracts, lives of heroes, martyrs, interpretation of dreams, fortune telling, weather forecasts, stories of ghosts, giants, and witches, and songs and ballads. After 1800 the chapbooks declined in popularity, and were succeeded by the penny magazine and other cheap publications. Collections of chapbooks can be found in many libraries. The New York City Public Library has an especially fine one, as does the Harvard University Library.

Consult Halliwell-Phillips, J. O., *Notices of Fugitive Tracts and Chap-Books*, published by the Percy Society (London 1849); Nisard, M. L. C., *Histoire des livres populaires* (Paris 1854); Fraser, John, *Humorous Chap-Books of Scotland* (New York 1873); Ashton, John, *Chap-Books of the Eighteenth Century* (London 1882); Faxon, Frederick W., "Ephemeral Bibles," in *Bulletin of Bibliographical Pamphlets* (Boston 1903); Harvey, William, *Scottish Chap-Book Literature* (Parsley, England 1903); "Catalogue of England and American Chap-Books and Broad-side Ballads in Harvard University," in *Bibliographical Contributions*, no. 56 (Cambridge, Mass. 1905); Mackensen, Lutz, *Die deutschen Volksbücher* (Leipzig 1927); Weiss, Harry B., *A Book about Chapbooks* (Trenton, N. J. 1942).

CHAPEAUX, shâ-pô' (Fr. *chapeaux*, hats), a name applied to the partisans of France in Sweden in the 18th century, while those favoring the cause of Russia were called Bonnets (caps). Having instigated war against Russia in 1741, and again in 1756, the Chapeaux declined in popularity for the calamities inflicted upon Sweden. Succeeding in 1769 in regaining their former position, the party was soon extinguished altogether by the advent of Gustavus III in 1772 and his reforms. The same names were also formerly applied in the Académie Française, the Chapeaux constituting the party supported by the philosophers and the public, and the Bonnets that party upheld by the clergy and the court.

CHAPEL, chăp'êl (Fr. *chapelle*, Lat. *capella*), a name for religious edifices of various kinds, especially for such as hold a subordinate position. In England and Scotland there are several kinds of chapels—parochial chapels, subordinate to, but distinct from, the mother church; chapels of ease, built for the accommodation of the inhabitants, in large parishes; university chapels, and private chapels, whose names explain their uses. The term is also applied to small buildings attached to cathedrals, and separately dedicated. In England Nonconformist places of worship are commonly called chapels in distinction from those of the established faith to which the term church is applied. In the early history of Massachusetts Bay Colony the Congregational body was the established church, and the first Episcopal church in Boston was consequently termed a chapel, retaining that name, King's Chapel, to the present time.

The word chapel is also applied to an association of union workmen in a printing office for the purpose of promoting and enforcing order among themselves.

Consult "Chapelle," in Viollet-le-Duc, Eugène E., *Dictionnaire raisonné de l'architecture française du XI^e au XVI^e siècle* (Paris 1854-1869); Martin, W. W., *Manual of Ecclesiastical Architecture* (Cincinnati 1897); Bond, Francis, *Westminster Abbey* (London 1909); Dhumez, Hubert, *Chapelles en Provence* (Cannes 1934); Cook, G. H., *Medieval Chantries and Chantry Chapels* (London 1947).

CHAPEL HILL, town, North Carolina, in Orange County; altitude 501 feet; 9 miles southwest of Durham on the Southern Railway. It is the seat of the University of North Carolina (q.v.), established in 1793. The Carolina Playmakers, founded in 1918 by Frederick H. Koch, here annually present plays based on the life and history of the state. Chapel Hill was incorporated in 1851 and has a city manager. Pop. (1950) 9,177.

CHAPEL ROYAL, in the Church of England, a body composed of a dean, a subdean, 36 royal chaplains, 10 canons, a lay choir, and an

organist. The services are performed in an oratory in Saint James's Palace. In Scotland such appointments are purely honorary, carrying with them neither emolument nor any obligation to conduct services.

Consult Sinclair, William, *The Chapels Royal* (London 1912).

CHAPELAIN, shâ-plân', Jean, French poet. one of the earliest members of the Académie Française: b. Paris, Dec. 4, 1595; d. there, Feb. 22, 1674. Having gained a high literary reputation after writing a preface for Giambattista Marini's *Adone*, translating Mateo Alemán's *Guzmán de Alfarache*, and composing four odes, he conceived the project of writing an epic on Joan of Arc, *La Pucelle*, which proved a total failure, although he spent over 20 years on it. The first 12 cantos appeared in 1656; and to so high a pitch had public expectation been wrought that notwithstanding the adverse criticism of Nicolas Boileau and Vincent Voiture, six editions came forth within the following 18 months. Eight new parts appeared in 1757, and the concluding four parts, which were never printed, are in manuscript in the imperial library of Paris. Cardinal Richelieu, to whom he dedicated a poem and whom he assisted in concocting literary works, conferred a pension on him. He presided over the organization of the Académie Française, took a conspicuous part in the early labors of that body, sat as academical critic upon Pierre Corneille's *Le Cid*, and possessed during nearly 40 years a literary prestige, unbroken until his publication of *Pucelle*, although he remained in favor with the court.

Consult Duchesne, Julien, *Les poèmes épiques du XVII^e siècle* (Paris 1780); Guizot, François P. G., *Corneille and His Times* (London 1852); Larroque, Tamizey de, ed., *Lettres*, 2 vols. (Paris 1880-1883); Fabre, L'Abbé, *Les ennemis de Chapelain* (Paris 1888); Bourgoïn, Auguste, *Les maîtres de la critique au XVII^e siècle* (Paris 1889); Fabre, L'Abbé, *Chapelain et nos deux premières Académies* (Paris 1890); Molènes, Emile de, ed., *La Pucelle par Jean Chapelain* (Paris 1891); Searles, Colbert, "The Library of Jean Chapelain," in *Bibliographical Society of America Papers*, vol. 5 (Chicago 1910); Collas, G., *Un poète protecteur des lettres au XVII^e siècle, Jean Chapelain* (Paris 1912); Saintsbury, George E. B., *History of Criticism and Literary Taste in Europe*, vol. 2 (New York 1902-1917).

CHAPELLE, shâ-pêl', Placide Louis, American Roman Catholic prelate: b. Runes, France, Aug. 28, 1842; d. New Orleans, La., Aug. 9, 1905. He studied at the college in Enghien, Belgium, but in 1858 came to the United States and after completing his theological course at St. Mary's Seminary, Baltimore, was ordained priest in 1865, the missions of Montgomery County, Md., being the scene of his first ministerial duties. In 1871 he was made assistant at St. John's Church and afterward rector of St. Joseph's Church, Baltimore, when he was appointed (1882) to the rectorship of St. Matthew's Church, Washington, D.C. On Aug. 21, 1891, he was made coadjutor to the bishop of Santa Fe, N. M.; in 1893 was elevated to the titular archiepiscopal see of Sebaste, and in less than a year succeeded Archbishop Salpointe in the see of Santa Fe. However, he was soon transferred to the diocese of New Orleans in 1897 and in September 1898 Pope Leo XIII appointed him apostolic delegate to Cuba and to Puerto Rico. One year later the Philippine Islands were placed under his care and able direction. Subsequently, he spent three months

in the discharge of his official duties in his country's new possessions. Within eight months he had consecrated four bishops for Cuba and three more for sees in other places. He died in New Orleans of yellow fever.

CHAPERON, shăp'ēr-ōn, a cap or hood. Such a covering, still worn by Knights of the Garter when officially robed, covers the head and neck to the shoulders. During the Middle Ages and the Renaissance it was in general use, but later was appropriated to doctors and licentiates in colleges. Today the word is most often applied to a matron or other mature person who acts as a guide or protector to a young unmarried woman or to a group of young people at social functions.

CHAPIN, chă'pĭn. **Edwin Hubbell**, American clergyman: b. Union Village, N. Y., Dec. 29, 1814; d. New York, Dec. 26, 1880. After studying law for a time he adopted Universalism and was ordained to the ministry in 1838. After 10 years as pastor in Richmond, Va., and Charleston, Mass., he became pastor of the Fourth Universalist Society in New York City. He was an associate editor of *The Christian Leader* in 1872. His congregation grew until it moved to the Church of the Divine Paternity on Fifth Avenue. A preacher of great eloquence and power, he was a founder of the Chapin Home for indigent men and women, and a trustee of Bellevue College and Hospital.

CHAPIN, Francis Stuart, American sociologist: b. Brooklyn, N. Y., Feb. 3, 1888. After studying at the University of Rochester he attended Columbia University, receiving his M.A. in 1910 and his Ph.D. in 1911. Later he became an instructor at Wellesley College and a professor at Smith, where he was also director of the Smith College Training School for Social Work from 1919 to 1921. Then he served as professor and chairman of the department of sociology at the University of Minnesota, 1922-1951; and while there was president of the State Conference of Social Work and president or member of a number of associations concerned with housing, social work, and social science research.

CHAPIN, Roy Dikeman, American automobile manufacturer: b. Lansing, Mich., Feb. 23, 1880; d. Detroit, Feb. 16, 1936. Upon leaving the University of Michigan in 1901 he became associated with the nascent automobile industry, and drove the first motor car to travel from Detroit to New York entirely under its own power. In 1910 he became president of the Hudson Motor Car Company, and in 1917-1918 was chairman of the Highway Transport Commission of the Council of National Defense. In 1932 President Herbert Hoover appointed him secretary of commerce to succeed Robert P. Lamont. He published *The Economics of Highway Transport* in 1921.

CHAPIN SCHOOL, The, is a day school for girls. Opened in New York City in 1901 by Maria Bowen Chapin of Providence, R. I., who died in 1932, it provided eight years of instruction for girls who later completed their training in other schools. In 1907, four years of high school, through the 12th grade, were added, so that graduates of the school should be

eligible for college. It has a regional accreditation. It was incorporated in 1925 as not for profit and since 1928 has occupied a building overlooking the East River at 84th Street.

CHAPLAIN, chăp'lĭn (Fr. *chapelain*). In an early sense a chaplain was a cleric in charge of a chapel. The term was also used to designate the king's secretary or man of affairs, later called chancellor. In France the designation *chapelain* was first applied to the cleric charged with guarding the cape (*chape*) of St. Martin accompanying the armies to the wars, then to priests who said masses in the camps. Later it was applied to priests officiating in chapels of royal palaces. The feudal lords imitated their sovereigns in having chaplains, either personal or family. This custom continued for centuries and was adopted by wealthy commoners. Chaplains are attached as spiritual advisers to religious houses and to individual high ecclesiasts. In some countries, as the United States, chaplains are attached to the armed forces. Some legislative bodies, as the United States House of Representatives, appoint a clergyman as their chaplain.

CHAPLAIN OF THE FLEET, The, a novel by Sir Walter Besant and James Rice, published in 1881. It gives a detailed account of the famous liberties or rules of the old Fleet Prison in London, and of the "Fleet marriages" (q.v.) of the 18th century. The rules applied to houses in certain streets near the Fleet Market, where prisoners for debt were allowed to live, outside the prison, on payment of fees. The book is a storehouse of antiquarian lore about houses, theaters, and the society of George III's reign, and is considered one of the best of those written jointly by Besant and Rice.

CHAPLEAU, shă-plō', **SIR Joseph Adolphe**, Canadian statesman: b. Sainte Thérèse, Quebec, Canada, Nov. 9, 1840; d. Montreal, June 13, 1898. Educated at Masson College, and the seminary at St. Hyacinthe, in 1861 he became a member of the bar, and in 1873 Queen's Counsel. He represented Terrebonne in the Quebec legislature, served as solicitor general, provincial secretary, and (1879-1882) as prime minister of Quebec. He was secretary of state for the Dominion for 10 years (to 1892) and lieutenant governor of Quebec until 1898. He held an LL.D. from Laval University and was knighted in 1896.

CHAPLIN, Charles Spencer, motion-picture actor and producer: b. London, England, April 16, 1889. Both his parents were in the theatrical profession, and his father, Charles Chaplin, Sr., was a well known vaudeville actor. After some schooling in South London, young Charles and his brother Sydney played in vaudeville. In 1910 he went to North America as leading comedian of the Karno Comedy Company, playing the principal vaudeville houses of the United States and Canada, until November 1913, when he joined a motion-picture company at Los Angeles, Calif. Here began his comic portrayal of the pathetic little tramp in baggy trousers and oversize shoes, facing the world in a certain jaunty fashion with his clipped mustache, his cane, and his battered derby. His films came to be recognized as great pantomime

art, and made "Charlie" a familiar figure to millions in all parts of the world. With his clowning was combined a subtle and often biting social satire that not always won him friends.

After appearing in motion pictures for the Keystone, Essanay, and Mutual companies, he built his own studios in Hollywood and formed the Charlie Chaplin Film Company in 1918. He produced such films as *A Dog's Life*, *Shoulder Arms*, *The Kid*, and *The Gold Rush*.

After 1923, as a co-founder with Mary Pickford, Douglas Fairbanks, and D. W. Griffith, of United Artists Corporation, he produced *The Circus*, *City Lights*, *Modern Times*, *The Great Dictator* (in which he first spoke), *Monsieur Verdoux*, and *Limelight*. Accusing him of leftist sympathies, the American Legion attempted to boycott the last film.

Chaplin, who had never relinquished his British citizenship, sailed on Sept. 17, 1952, for a world cruise. Two days later Attorney General James P. McGranery ordered immigration officials to bar his re-entry to the United States until Chaplin had been investigated. Unmoved by this, France made him, in October, an officer of the Legion of Honor. In April 1953, Chaplin surrendered his re-entry permit, refusing to face a hearing on his political views; and, insisting that it was no longer possible for him to work in the United States, he put his home and studios up for sale. In August 1953, he and his fourth wife settled in Geneva, Switzerland.

CHAPLIN, Henry, 1st Viscount CHAPLIN, English politician and sportsman; b. Ryhall Hall, near Stamford, England, Dec. 22, 1840; d. London, May 29, 1923. After studying at Harrow, he went to Christ Church, Oxford, where he formed a friendship with the prince of Wales (afterward Edward VII). Hunting and racing were his primary interests; politics came second. He was master of fox hounds to the Burton Hunt, 1865-1871, 1877-1881, but had to forego his customary daily hunting when he was returned in 1868 to Parliament from Mid-Lincolnshire (a seat he held until 1906), and when he represented Wimbledon from 1907 to 1916. During 1889-1892 and 1895-1900 he served in Lord Salisbury's cabinets, devoting himself mainly to agricultural legislation. In 1916 he was created a viscount. Part of his popularity was undoubtedly due to the fact that his colt Hermit won the 1867 Derby at odds of 66 to 1. He was considered by his contemporaries to be a magnificent example of the sportsman-politician of his day. In 1922 he published *Foxhounds and their Handling in the Field*.

CHAPMAN, Alvan Wentworth, American botanist; b. Southampton, Mass., Sept. 28, 1809; d. Apalachicola, Fla., April 6, 1899. Graduating from Amherst College in 1830, he began his career as a physician, and practiced surgery in Florida, but his hobby was botany, in which he had no academic training. He began sending specimens to the famous Northern botanists Asa Gray and John Torrey, who named a genus *Chapmania* in his honor.

When his Union sympathies during the Civil War caused him some trouble, he gave up his medical practice to devote his time to botany. His *Flora of the Southern States* (1860) made him a leading authority among botanists of the South.

CHAPMAN, Carlton Theodore, American painter and illustrator; b. New London, Ohio, Sept. 18, 1860; d. New York, N. Y., Feb. 12, 1925. His schooling was at Oberlin, Ohio, but he studied art at the National Academy of Design and the Art Students' League in New York City, and at the Académie Jullian in Paris. He specialized in marines and landscapes, and in the Spanish-American War was a war correspondent and artist for *Harper's Weekly*, for which he painted many scenes of naval action.

CHAPMAN, Frank Michler, American ornithologist; b. Englewood, N. J., June 12, 1864; d. New York, N. Y., Nov. 15, 1945. As associate curator, then curator of ornithology in the American Museum of Natural History, New York, from 1888, he originated the presentation of bird groups and seasonal bird exhibits. During explorations in temperate and tropical America he made many excellent close-range photographic studies of bird life. Besides many papers in scientific journals he published *Handbook of Birds of Eastern North America* (1895) and was founder and editor of *Bird-Lore*.

CHAPMAN, George, English poet and dramatist; b. near Hitchin, Herts, England, about 1559; d. London, May 12, 1634. So far as is known, he was educated at Oxford and Cambridge, then went to London, where he became acquainted with Ben Jonson, Edmund Spenser, John Fletcher, Christopher Marlowe, and other writers of the Elizabethan age. His first published work, *The Shadow of Night*, a poem, was brought out in 1594; but it was not until 1598 that his masterpiece, the translation of Homer's works, began to appear. His rendition of the *Iliad* was published in three parts between 1598 and 1609, and the completed version was entered on the Stationers' Register on April 8, 1611. In 1614-1615 appeared his translation of the *Odyssey*, and in 1624 he concluded his translation of the *Hymns*.

Chapman's translations of Homer, though often criticized as inexact and awkward, are virtually original works, and are considered one of the enduring monuments of English literature. It inspired John Keats' sonnet, *On First Looking into Chapman's Homer*, itself a classic. Although the list of Chapman's plays and other works is long, it is for his translations from Homer that he is famed. An edition of his works (in three volumes) was published in 1873-1875, with a critical essay by Algernon Charles Swinburne. A collection of his poems edited by Phyllis Brooks Bartlett appeared in 1941 (New York and London).

CHAPMAN, John (nicknamed JOHNNY APPLESEED), American pioneer; b. Leominster, Mass., Sept. 26, 1775; d. Allen County, Ind., March 1845. A Swedenborgian, he deemed himself called to a mission in the West. He made his way to western Pennsylvania, navigated a boatload of apple seeds and seedlings down the Ohio, landed, planted apples over hundreds of miles of country, and came to be known as "Johnny Appleseed." Wherever he could find listeners, he read Swedenborg to them. Many legends sprang up about him, and he became a folk hero, the subject of poems, paintings, and musical compositions.

In 1812, learning that the Indians were about

to raid the village of Mansfield, Ohio, he made his way through the woods, by night, to Mount Vernon, 36 miles away, and brought troops to defend the town.

In the late 1830's "Johnny" made his way into northern Indiana. He died of pneumonia, and was buried at Fort Wayne.

Consult Himrod, J. L., *Johnny Appleseed* (Chicago 1926); *Johnny Appleseed*, by Harlan Hatcher and others (Paterson, N. J., 1945).

CHAPMAN, John Jay, American lawyer and essayist: b. New York City, Mar. 2, 1862; d. Poughkeepsie, N. Y., Nov. 4, 1933. He was graduated from Harvard in 1884, admitted to the New York bar in 1888, and was in active practice there until 1898. His essays and speeches attracted considerable attention because of their striking individuality and original point of view. His works include *Emerson, and Other Essays* (1898); *Causes and Consequences* (1898); *The Maid's Forgiveness*, a play (1908); *A Sausage from Bologna*, a play (1909); *Learning, and Other Essays* (1910); *The Treason and Death of Benedict Arnold*, a play (1910); *William Lloyd Garrison* (1913); *Notes on Religion* (1915); *The Greek Genius* (1915); *A Glance Toward Shakespeare* (1922); *Letters and Religion* (1924); *Dante* (1927); *John Jay Chapman and His Letters*, ed. by M. A. DeW. Howe (Boston 1937).

CHAPMAN, Maria Weston, American reformer: b. Weymouth, Mass., July 25, 1806; d. there, July 12, 1885. She received her education at Weymouth and in England. In 1829-1830 she was principal of the Young Ladies' High School, Boston. She married in 1830; became an active opponent of slavery in 1834; and after the death of her husband in 1842, went to Paris, France, and assisted the anti-slavery cause with her pen, returning to America in 1856. She wrote *Right and Wrong in Massachusetts* (1839); *Right and Wrong in Boston: Report of the Boston Female Anti-Slavery Society*, 5 vols. (1836-1840); and compiled the anti-slavery hymnbook, *Songs of the Free, and Hymns of Christian Freedom* (1836). In 1877 she edited the two-volume autobiography of her friend, Harriet Martineau.

CHAPMAN, Oscar Littleton, American public official: b. Omega, Va., Oct. 22, 1896. Educated at the universities of Denver and New Mexico, he was assistant chief probation officer of the Juvenile Court, Denver, 1922-1924; chief, 1924-1927. He graduated from Westminster Law School, Denver, and was admitted to the bar in 1929. Appointed assistant secretary of the interior in May 1933, he became under secretary in 1946, secretary in 1949, resigning in January 1953 with the change of administration.

CHAPMAN'S HOMER. George Chapman (1559-1634), writer of plays and contemporary of Spenser, Marlowe, Jonson and Shakespeare, was a great translator in the great age of translations that brought forth the English Bible and so many versions and adaptations of the ancient classics. He published seven books of the *Iliad* in 1598, and by 1616 had published together the *Iliad* and the *Odyssey* complete in rhymed 14 syllable verse. The literature of his own time contains much complimentary allusion to him, and the

esteem of later generations is manifest in many glowing tributes from eminent literary characters, probably the most familiar and the most stimulating being Keat's sonnet, "Much have I travelled in the realms of gold":

"Oft of one wide expanse had I been told
That deep-browed Homer ruled as his demesne;
Yet did I never breathe its pure serene
Till I heard Chapman speak out loud and bold...."

The "loud and bold" of Keats contains or suggests the qualities that have made Chapman's translation live in spite of the lack of polish, of exactness, and sometimes of dignity, that are charged against it. Pope, his later rival, says "he covers his defects by a daring fiery spirit that animates his translation." Even Matthew Arnold, the severe critic of all translations of Homer, who declares that "in a verse translation no original work is any longer recognizable," characterizes Chapman as "plain spoken, fresh, vigorous, and, to a certain degree, rapid." Arnold, however, condemns him on the whole. "Homer," he says, "is rapid in his movement. Homer is plain in his words and style, Homer is simple in his ideas, Homer is noble in his manner . . . Chapman renders him ill because he is fantastic in his ideas. . . . His conceits are un-Homeric, and his rhyme is un-Homeric; his manner and movement are un-Homeric; his diction . . . often offends . . . by wanting Homeric nobleness." He condemns him most of all because "he cannot forbear to interpose a play of thought between his object and its expression. Chapman translates his object into Elizabethan, as Pope translates it into the Augustan of Queen Anne; both convey it to us through a medium." "For the Elizabethan age," write Butcher and Lang in the preface to their translation of the *Odyssey*, "Chapman supplied what was then necessary, and the mannerisms that were then deemed of the essence of poetry, namely, daring and luxurious conceits . . . Without Chapman's conceits, Homer's poems would hardly have been what the Elizabethans took for poetry; without Pope's smoothness, and Pope's points, the *Iliad* and the *Odyssey* would have seemed tame, rude, and harsh in the age of Anne." If, as Arnold reasonably insists, the real test of successful translation is the attempt to satisfy the scholar who has also poetical feeling, Chapman must be said to please most those not perfectly possessed of the means of really judging him as a translator, but who come to his work more or less as to an original poem in the Elizabethan manner. Such readers will find him admirable for what R. H. Horne calls "his commanding energies, fullness of faith in his author's genius, and in his own inspired sympathies, his primitive power, and rough truthfulness of description"; and will feel not only the inspiration of the Homeric narrative but the inspiration of the translator himself.

GRANT SHOWERMAN.

CHAPPE, shăp. **Claude**, French abbé and inventor: b. Brûlon (Sarthe), 1763; d. Paris, Jan. 23, 1805. Having invented an ingenious system of signals to communicate at a distance with his friends, he presented it to the French Legislative Assembly in 1792. It was successfully tried between Paris and Lille, on a length of 48 leagues, and was adopted by the government. Chappe established several lines in France, and the one running north was first put in motion

to announce the recapture of the town of Condé from the Prussians. The inventor was at once rewarded by the convention, which, by a decree, appointed him *ingénieur télégraphe*. The lines were extended all over France, and the system was also adopted, with some alterations, through Germany and England. The attacks to which he was subjected, by persons jealous of his invention, preyed so much upon his mind that he committed suicide. His semaphore consisted of an upright post, with a transverse bar at top, and with two smaller arms movable on pivots. The position of the bars represented letters or words, and the posts were placed within visible distance one of another. Messages were conveyed a distance of 150 miles in 15 minutes by this method. Consult *Histoire de la Télégraphie* (1824) by Ignace Urbain Jean Chappe, brother of Claude Chappe.

CHAPPE D'AUTEROCHE, shâp dô-trôsh', Jean, French astronomer: b. Mauriac, Auvergne, March 2, 1722; d. San José, Calif. Aug. 1, 1769. He was a priest, but giving his whole attention to astronomy, became one of the assistants of Cassini in delineating the general map of France, and edited the astronomical tables of Halley. In 1760 he was designated by the academy to make an observation of the transit of Venus over the sun's disc, which Halley announced would happen June 6, 1761. He consequently set out for Tobolsk, in Siberia, which was pointed out as the most favorable point of observation. His mission was successfully accomplished; and returning to France at the end of two years, he published in 1768 his *Voyage en Sibirie*. The following year he sailed for California to observe another transit of Venus, which was to take place June 3. He was equally successful on this occasion, but died soon afterward. The results of his last expedition were published by Cassini, under the title of *Voyage de la Californie* (Paris 1772).

CHAPPED HANDS, a form of eczema (*eczema fissum*), caused by exposure to extremes of cold and heat. The skin swells and cracks and there is itching, pain and heat and in severe cases ulceration. The lesions are generally treated with oxide of zinc ointment, or a solution of borax in glycerin and rose water or with glycerin alone. The hands should be protected by warm gloves. Chapping may be avoided to a great extent by washing the hands with a bland soap in tepid water and thoroughly drying them afterward.

CHAPPELL, chăp'él, William, English musical antiquary: b. London, Nov. 20, 1809; d. there, Aug. 20, 1888. For the most of his life he lived in London, where he was for some years a member of a great music publishing house. His works of importance include: *Collection of National English Airs* (1838-1840); and *Popular Music of the Olden Time* (1855-1859). He took a principal part in the foundation in 1840 of the Percy Society and the Musical Antiquarian Society, and published the first volume of *History of Music* in 1874.

CHAPPLE, Joe Mitchell, American journalist: b. La Porte City, Iowa, July 18, 1867; d. Miami, Fla., April 17, 1950. He studied at Cornell College, Iowa, and was engaged

in journalism in Dakota, Ashland, Wisconsin, and Chicago until 1897, when he became editor and publisher of *The Bostonian*, later changed to *The National Magazine*, Boston, Mass. His writings include *The Minor Chord* (1895); *Heart Throbs* (1906); *The Panama Canal* (1907); *The Happy Habit* (1908); *Heart Songs* (1909); *History Making* (1911); *Heart Letters* (1912); *Heart Chord* (1915); *Harding, the Man* (1923); *Vivid Spain* (1927); *Our Jim* (1929); *Face to Face With Our President* (1930); *Chapel Bells* (1934); *Mother O'Mine* (1935); *Willkie and American Unity* (1940). He produced a series of motion pictures and had a nationwide radio program (1945).

CHAPTAL, shâp-tâl, Jean Antoine Claude, COMTE DE CHANTELOUP, French chemist and statesman: b. Nogaret, Lozère, June 4, 1756; d. Paris, July 30, 1832. During his medical studies and practice he devoted much research to the science of chemistry, in which he soon became eminent, and was appointed professor at Montpellier, where he taught successfully the doctrines of Black, Lavoisier and Cavendish. He established chemical works near Montpellier, the first attempted of the kind, by which he was soon enabled to produce various chemicals hitherto imported, such as the mineral acids, alum, soda and salts of lead. The authorities of Languedoc heaped honors on him; the Spanish government offered him a pension of 56,000 francs to go to Spain, and according to his biographer, Washington wrote three times to Chaptal, inviting him to America. After the outbreak of the French Revolution he published a political pamphlet, entitled *Dialogue Between a Montagnard and a Girondist*, and was arrested, but through the intercession of friends was liberated. The committee of public safety placed him in charge of the powder mills of Grenelle, now a part of Paris, which produced, under his management, 3,500 pounds of gunpowder daily. Once more returning to Montpellier, he was elected member of the Institute, and devoted himself to science, until Bonaparte summoned him to the council of state, where he had the supervision of national education. When Lucien Bonaparte resigned the portfolio of the interior, Chaptal took his place as minister, and for four years performed the duties of the department with much administrative ability. He founded the conservatory, school of arts, chambers of commerce and society for encouragement of industry, introduced the modern French system of weights and measures, established a model farm and a system of distribution of agricultural seeds, reorganized the prisons and hospitals, extended the network of highways over the face of the country and organized the carrying out of the plans of extension of the Louvre and rues de Rivoli and Castiglione, since completed by Napoleon III. On Napoleon's return from Elba, the count was appointed director-general of commerce and manufactures and minister of state. Louis XVIII struck him from the list of peers, but left him on the roll of the academy. His works are all on chemical subjects, and may yet be consulted with advantage.

CHAPTER (Latin *caput*, head), one of the chief divisions of a book. As the rules and statutes of ecclesiastical establishments were arranged in chapters, so also the assembly of

the members of a religious order, and of canons, was called a chapter, because some or all of the chapters containing the rules were read there; and the place where they assembled, as well as the reproof administered to a delinquent member, by reading the chapter rules, which he had transgressed, had the same name. The knightly orders, which originally had much of the ecclesiastical constitution, used this expression for the meetings of their members, and even some corporations of mechanics or tradesmen called their assemblies chapters. In England, as elsewhere, the deans and chapters had the right to choose the bishop, but Henry VIII (r. 1509–1547) assumed this right as a prerogative of the crown. In the United States, the local branches of national Greek-letter societies are called chapters of the society.

CHAPTER HOUSE, a building attached to a cathedral, collegiate church, or church belonging to a religious house, in which the chapter meets for the transaction of business. Chapter houses are of different forms, sometimes regular polygons of 4, 8, or 10 sides, and in other cases circles or parallelograms; and their architecture is often noteworthy.

Continental chapter houses are always rectangular in shape. Among the most notable of English chapter houses are those at Lincoln Cathedral, which is decagonal, with vaulting springing from a central column; Salisbury Cathedral, octagonal, with fine sculptures; Wells Cathedral, octagonal, the finest Decorated chapter house in England; Southwell Minster, octagonal, with a beautiful roof unsupported by a central pillar, and with fine early carving; York Minster, octagonal, an example of Decorated work of great beauty, Worcester Cathedral, circular, with a single shaft.

Bristol Cathedral has a chapter house of the Norman period, in shape a parallelogram. The chapter houses at Gloucester and Canterbury cathedrals are also parallelograms: Gloucester, Norman (restored), with Perpendicular east bay; the lower part of Canterbury's chapter house completed during the first part of the Perpendicular period (late 14th to mid-16th centuries).

CHAPULTEPEC, chā-pōōl-tā-pēk' (meaning Grasshopper Hill), a rocky hill about 200 feet high and three miles southwest of Mexico City. The early Aztecs, who took it from the native Indians, built aqueducts here to supply their capital with water; Aztec emperors used the hill as a pleasure ground. Sharply precipitous on the northern, eastern, and part of the southern sides, it slopes gradually on the west and southwest to level marshy ground partly covered with a cypress grove. In 1783 the Spanish began to build a castle on the summit for their viceroys' summer residence, but abandoned construction after four years. In 1840 work was resumed and in 1842 a military academy was installed in it. Just before the Mexican War (1846) the castle was fortified to command the main road into Mexico City from the southwest. After its capture in 1847, Gen. Winfield Scott used the castle as temporary headquarters.

In 1864 the fortress became the imperial castle of Emperor Maximilian and Empress Carlota, who thought the view from the hill one of the most beautiful in the world, surpassing even that of Naples. The castle was renovated for them in

European style, with gilt furniture, damask and French tapestries, glittering chandeliers, statuary, and marble urns. There they received and entertained the refugee Confederate generals, whom they encouraged to settle in Mexico after the Civil War.

During the republic President Porfirio Díaz used it as a residence until he was exiled in 1911. Under President Lázaro Cárdenas in 1937, the hill was made into a public park and the castle became a museum. In 1945 it was the scene of the Inter-American Conference on Problems of War and Peace, which formulated the Act of Chapultepec. A new residential section, Chapultepec Heights, now adjoins the hill on the northwest. See also **PACTS AND CONFERENCES: WORLD WAR II.—Act of Chapultepec.**

BATTLE OF CHAPULTEPEC

After the victory of Molino del Rey (q.v.) in the Mexican War, United States troops prepared for the assault on Chapultepec on Sept. 12–13, 1847. The Mexican general, Nicolás Bravo, commanded a garrison of 800, including 40 students of the military academy. Along its approaches were some 4,000 to 4,500 more troops but Gen. Antonio López de Santa Anna dared not strip the other entrances to Mexico City. The hill was guarded by strong batteries, and protected by walls (an aqueduct on the north) which shielded other batteries; through the marshy fields in front of these were irrigating ditches, some large and deep, with high banks and sticky bottoms, very serious obstacles to troops and artillery.

On the 8th, Gen. Winfield Scott had captured a set of long stone buildings southwest of Chapultepec and forming some protection for artillery, though under the castle's guns. Scott's troops numbered 7,500.

On the 12th, Capt. Benjamin Huger planted heavy batteries there and at three other places, to range the south and west of the hill (the only accessible portions), on which an assault had been determined; their fire gradually silenced that from Chapultepec, breached the defenses and caused much loss. About 8 A.M. on the 13th Scott launched two assaulting columns: Brig. Gen. Gideon J. Pillow on the west, from Molino del Rey through the cypress grove, supported by Maj. Gen. William J. Worth; Brig. Gen. John A. Quitman against the south from the heights of Tacubaya, where Scott had his headquarters, supported by Brig. Gen. Persifor F. Smith. Preceded by the pioneer companies with ladders, axes, picks, and crowbars, and under a plunging fire, they surmounted all obstacles, cleared the approaches, broke through the walls, climbed the heights, entered the castle gates, and, having cut off retreat by the northwestern road to Mexico City, captured the entire garrison. The approaches and castle had been mined, but the defenders waited too long before exploding the mines and failed. The next day the United States Army overcame all remaining resistance and entered the capital. Their loss in these three days was 863 killed and wounded. The Mexican loss was unknown, but certainly as heavy, and included several brilliant and gallant officers; and 823 prisoners were taken, including three generals, one the commandant of the academy. Among the United States officers prominently engaged were many afterward distinguished in military and civil life.

Consult Bancroft, H. H., *History of Mexico*, vol. 5 (San Francisco 1885); Wilcox, C. M., *History of the Mexican War* (Washington, D.C., 1892); Henry, R. S., *Story of the Mexican War* (Indianapolis 1950).

CHAR or **CHARR**, chär, a genus of fishes (*Salvelinus*) found plentifully in deep lakes of Great Britain and the northern European continent as well as in North America. Anything stated about them must be considered provisional, since they are still the subject of great indecision specifically. The best-known varieties of char are the American brook trout, a variety found in the Rangeley Lakes, Maine, very similar to the European char, and the much-discussed Arctic char, which is still being studied. They have the usual shifting and beautiful colors of the other trout and are all good eating. They range in size from a more usual weight of under 1 to 35 pounds.

CHRISTOPHER W. COATES.

CHARACTER, a word originally denoting a die for stamping coins as well as the device stamped upon them. The word comes directly from ancient Greek. In familiar usage its meaning became broadened to include a device for marking or writing, such as a stylus, and the symbols produced through its use. In contemporary English the word retains this sense, and it may be used to allude to letters of the alphabet or other signs in handwritten or printed language. By the 5th century B.C. character had acquired the meaning of the unique, differentiating aspects of an individual, a nation, or a form of literary expression. Such writers as Herodotus and Aeschylus employed it in this broad sense. The classical rhetoricians and literary critics used the word to designate various literary forms and personages in literature. This ancient connotation has been retained in modern usage. Thus, one speaks of the characters in a Shakespearean play, for example, or of "characters from the pages of history." There is justification for using the word character as a synonym for personality.

Implied in the ancient Greek denotation of the word is an emphasis upon something which is unique. Obviously, to thwart counterfeiters the Greeks took utmost care with their *characters*—namely, the dies used to mint coins and the devices on the coins. This connotation doubtless led to the use of the term in such literary characterizations of types as that attributed to Theophrastus (d. about 287 B.C.) and introduced into European literature as a popular literary form by Jean de La Bruyère (1687). A "character" was an interesting type of individual described in an entertaining, concise essay. In more recent years (1912-1932), the Boston writer Gamaliel Bradford revived this literary convention in his "psychobiographies" or character sketches of eminent persons; and Edgar Lee Masters created fictitious characters in the stanzas of his *Spoon River Anthology*.

The Christian theologians employed the word in a different sense. St. Augustine, for instance, mentions the unique characters or signs which the soul receives as the individual goes through the various rites of the church. St. Thomas Aquinas established this use when he wrote of *character baptismatis* and *character confirmationis*. One achieves character by observance of religious practices, and the soul gradually takes on new

attributes as a result. The older connotations still continued in daily speech and secular writing, and the word acquired many different meanings.

Immanuel Kant invested the word character with an ethical or religious meaning. In his *Kritik der reinen Vernunft* (1781) he distinguished between empirical character (that which follows the natural laws of cause-effect and which is determined) and intelligible character (that which is not subject to causal laws and which is free to choose). In his *Anthropologie* (1798) he describes physical character (the body and its disposition or temperament) and moral character (that nonmaterial aspect of man which he may achieve through ethical striving). He proposed that the term character be limited in use to designate nothing but what he referred to as moral character.

Modern writers on biology, however, often use the word to designate physical traits or characters. Lamarck (1744-1829), for instance, wrote about the possibility of hereditary transmission of acquired characters. August Weismann (1834-1914), on the other hand, upheld the view that congenital characters (in this restricted sense of the word) are biologically inherited but that acquired characters cannot be transmitted. Contemporary writings on genetics often contain allusions to Mendelian characters such as white forelock or webbed fingers.

In ethics and in educational psychology the word connotes an evaluation of personality in terms of some code or standard of moral principles. Thus, when a person's character is evaluated, the judge must take a moralistic, judgmental point of view. The Christian and the Hebrew theologians find in the Scriptures those standards or norms whereby they are able to make evaluations of the moral worth or character of human beings. In legal evaluations the court makes use of precedents or of codes to attempt to make objective, impartial judgments about the character of a person on trial. Witnesses may be called to testify as to his character. In this frame of reference, the evaluation and the definition of character may become ambiguous and subjective. Nevertheless, there does seem to be a need to have valid standards whereby character may be evaluated. A major objective in educational work, religious and secular, is the furtherance of character development. The principal difficulty in secular endeavor is that of finding a valid, tenable, just code or norm for evaluations.

The popularity of cultural anthropology as a field of study has disseminated the concept of moral relativism. That means that judgments may be made only when the total frame of reference is taken into account as it exists in the particular society or subculture. Actions which indicate a nobility of character in one age may be quite impossible in another age. Similarly, there are no objective codes whereby any conduct may be evaluated in terms of character. Needless to say, this concept has aroused indignant replies from ethically and religiously oriented persons.

Studies of juvenile delinquency have brought into attention the concept of determinism. This, like the concept of moral relativism, is a disturbing view to those who uphold the belief in moral absolutes and in freedom of choice. In the Kantian sense of the term, character implies a negation of both of these concepts. The individual must be judged by his actions, and in these

matters he has freedom of choice. If he has a low character, he chooses low goals; if he is noble in character, he chooses lofty goals. Obviously, the adjectives "low" and "lofty" imply an acceptance of moral absolutes. Complex questions arise in the study of the theory of ethics, and these are but two relatively simple examples.

In 1928 the first of a series of important research investigations dealing with character was published. Known as the *Character Education Inquiry*, these reports describe the manner in which various character traits (for example, honesty) were defined, the techniques devised to measure them, and the results of an intensive program of testing. Hartshorne, May, and others (see bibliography) tested more than 11,000 pupils from 6 to 16 years of age. Some representative findings are of interest here: (1) attendance at Sunday schools of the conventional type and memberships in youth organizations which are designed to foster character development have very little relation to scores on honesty-deception tests; (2) much inconsistency is found among measures of honesty-deception, pupils honest in one situation cheating in another; and (3) there is a significant relationship between the scores on these tests and the socioeconomic status of the home, pupils from privileged homes having better scores than those from marginal homes. This objective inquiry into the nature of character has stimulated a considerable amount of research by other investigators in many parts of the world.

Educators in American secondary schools have accepted as one of their cardinal objectives the promotion of ethical character in their pupils. A large amount of thought is being given to the methods whereby this objective may be attained. There is widespread recognition of the necessity to foster growth in moral character. Important developments have been made in the field of religious education by such reformers as Luther A. Weigle, of the Yale Divinity School. School and college administrators are frank in their statements about practices which may militate against this objective (such as commercialized, subsidized athletics in American colleges). New techniques in character education are supplanting traditional reliance upon exhortations, forbidding and threatening, and overuse of corporal punishment. A great amount of research is still needed in order to work out intelligent, effective methods in this field.

Bibliography.—Bain, A., *A Study of Character* (London 1861); Hartshorne, H., May, M., and others, *Studies in the Nature of Character: I, Studies in Deceit* (1928); *II, Studies in Service and Self-control* (1929); and *III, Studies in the Organization of Character* (New York 1930); Allport, G., *Personality* (New York 1937); Roback, A., *The Psychology of Character* (London 1953).

PHILIP LAWRENCE HARRIMAN,

Professor of Psychology, Bucknell University.

CHARACTERISTICS, the title of a volume by Anthony Ashley Cooper, 3d earl of Shaftesbury, consisting of six treatises collected and published in 1711 under the full title *Characteristics of Men, Manners, Opinions, and Times*. They comprised *A Letter Concerning Enthusiasm*; *Sensus Communis: An Essay on the Freedom of Wit and Humour*; *Soliloquy, or Advice to an Author*; *An Inquiry Concerning Virtue*; *The Moralists: A Political Rhapsody*; and *Miscellaneous Reflections*. Two more essays appeared in posthumous editions. The book is the

principal lifework of a cultivated and high-minded Whig nobleman, who, debarred by ill health from a public career, dedicated himself to the study, practice, and inculcation of moral philosophy. Writing for a skeptical and rationalizing age, Shaftesbury is primarily concerned to show that goodness and beauty are not determined by revelation, authority, opinion, or fashion, but by the essentially constant and inalterable nature of man and things.

From his *Philosophical Regimen*, first published in 1900, it appears that he had reached his own convictions by a rigorous process of self-examination and self-discipline in imitation of his favorite classical masters, Epictetus and Marcus Aurelius. In common with the Stoics of antiquity and the Deists of his own time, he finds in the general harmony of the universe objective evidence of a supremely benevolent Mind, to whose purposes it is the part of every man's wisdom to conform. In distinction from Thomas Hobbes, he holds that human society was not created by a contract but was inherent from the first appearance of man in the world, in the natural and necessary relations of male and female, parents and offspring. In distinction from John Locke, the supervisor of his early education, he denies that all our ideas are derived from experience, insisting that our conceptions of right and wrong are, if not precisely innate, yet predetermined and appointed for us by our physical and mental constitutions and by our destiny as social beings. To study the "natural" law of one's own being and of one's relations to one's fellow beings and to the universe is essential, Shaftesbury persuades us, to the character of a fine gentleman and a man of sense. "To philosophize, in a just signification, is but to carry good breeding a step higher. For the accomplishment of breeding is to learn whatever is decent in company or beautiful in arts; and the sum of philosophy is, to learn what is just in society and beautiful in Nature and the order of the world."

This passage suggests what is perhaps the most personal aspect of Shaftesbury as a moralist—his aesthetic sensibility, his identification of the good with the beautiful, his insistence that conduct is a fine art with principles analogous to those of music and sculpture, and to be relished by every gentleman of taste. To a public beginning to take pride in its civility, in its tolerant and equable temper, in its devotion to common sense, Shaftesbury's studious ease and serenity appeared admirable, his urbanity worthy of emulation, his suave irony delicious, and his benevolent and optimistic metaphysics an acceptable antidote to the egoism of Hobbes and the pessimism of the theologians. He attained in the 18th century a wide reputation in England and abroad, influencing such men as Gottfried Wilhelm von Leibniz, Johann Gottfried von Herder, Benjamin Franklin, Voltaire, Denis Diderot, baron de Montesquieu, Alexander Pope, Francis Hutcheson, David Hume, and Joseph Butler. In the reaction which followed the French Revolution his political and religious liberalism was disparaged as atheistical and revolutionary; whereupon it was discovered that his style was artificial and pedantic. In the 20th century there have been some attempts at a critical restoration, notably in J. M. Robertson's edition of the *Characteristics*, 2 vols. (London 1900), and in Benjamin Rand's *The Life (by his Son)*. Unpublished *Letters and Philosophical Regimen of the Third*

Earl of Shaftesbury (London 1900), where Shaftesbury is ranked with Epictetus and Marcus Aurelius as one of the "three great exponents of stoical philosophy."

STUART P. SHERMAN.

CHARACTERS (Fr. *CARACTÈRES*), a collection of Jean de La Bruyère's reflections on human nature and conduct and of "portraits" of different types of character or varieties of moral development, studied with patient and penetrating observation and drawn with extraordinary skill in a few precise, significant and revealing lines. They are distributed over 16 chapters: heart, society and conversation, material possessions, the city, the court, persons in high station, the sovereign or the state, man, judgments, fashion, certain usages, the pulpit, the strong minded. They derive in part from the *Characters* of Theophrastus and appeared for the first time (1688) as an appendix to a translation which La Bruyère had made of that work, modestly hiding behind the Greek even in the title: *The Characters of Theophrastus, Translated from the Greek, Together with the Characters and the Manners of this Century*. They also continue the "portraits" long popular in the novels of the time and in the literary recreations of certain salons. But these portraits are no longer complimentary and flattering, as those had been. Instead, they insist pitilessly on the unlovely realities of motive that too often lie behind the smiling mask of manners. La Bruyère was a sharp-eyed observer of the brilliant society of court and salon. Indeed, there were many complaints from those who saw themselves in the satiric pictures which he drew, though he disclaimed the intention of painting particular persons. His view of human nature is less embittered than that of his great contemporary the Duc François de La Rochefoucauld in the *Maxims*, but it is stern and hard, lacking in pity and tenderness. To the composition of his *Characters* he brought a rare command of the French language, which he cultivated with infinite pains, and the judgment of Marie-René Valléry Radot is often quoted with approval: "If you wish to take an inventory of the riches of our language, if you wish to know all its ins and outs, its movements, its figures, its resources, there is no need to have recourse to a hundred volumes; read, reread La Bruyère."

The *Characters*, by the progress which they mark in the art of psychological observation and moral characterization, also contributed substantially to the development of the novel, and their influence was clearly seen soon in English writers, such as Joseph Addison and Richard Steele. Several translations, one by Nicholas Rowe (1709), were made, but none, however, is current. The standard edition is that of M. G. Servois in the series of the *Grands Écrivains de la France*, 3 vols. (Paris 1865-1868; 3d ed., 6 vols., Paris 1922).

ARTHUR G. CANFIELD.

CHARADE, shā-rād', a syllabic enigma or riddle to be solved by guessing each syllable of a word separately as an individual word, then guessing the whole. This may be done in writing, a method in which the French have excelled, or more popularly as a guessing game for a social gathering. The company choose sides, one side becoming actors, the other audience. In either

pantomime or dialogue the actors proceed to give a short scene in which each syllable is acted or spoken, finally acting out the whole word. If the audience guess the word correctly, they in turn become actors.

CHARADRIIFORMES, kā-rād-rī-ī-fōr'mēz, an order of birds, most of whose members live on or near the ocean or other bodies of water. The order consists of three main subgroups or suborders: (1) Charadrii, or the shore birds, such as plovers, sandpipers, and avocets; (2) Lari, or the gulls, terns, and skimmers; and (3) Alcae, or the auks, puffins, and murres.

CHARAS. See **HEMP**.

CHARCOAL, chār'kōl, a black, solid, non-lustrous residue, or amorphous carbon, from vegetal or animal substances; or a coal made by charring wood in a kiln or retort from which air is excluded. Where it is a hardwood distillation product, it has 84 per cent fixed carbon, 14 per cent volatile matter, 2 per cent ash, and a trivial amount of sulphur. Charcoal is used for fuel—in blast furnaces to manufacture charcoal iron, for domestic and institutional purposes, for metallurgical fuel other than in the blast furnace, and for nonferrous metal works. In the past its largest industrial use was as a fuel in connection with the making of charcoal iron. In the 20th century this use has declined to a minimum percentage. Since 1930 the largest single outlet for charcoal has been for use in the United States.

Charcoal produces a quick, hot fire. The glowing coals developed by burning charcoal are especially suitable for broiling and roasting foods in cafés, restaurants, trains, homes, and outdoor grills. Because of its efficiency as a cooking fuel, it is admirably adapted for use by persons of modest incomes: metropolitan New York City consumes some 3 million bushels annually. It is a popular fuel in the Southern states. As a chemical it is employed in the manufacture of carbon bisulphide, carbon tetrachloride, sodium cyanide, and similar substances. It is used in mixed feeds for poultry and livestock and is an absorbent for vapors and a clarifying, deodorizing, and decolorizing agent.

Activated charcoal is becoming increasingly important in treating municipal water supplies and can control offensive odors from sewage sludge beds. Impurities which make for objectionable tastes, odors, and colors, in oils, sirups, beverages, medicinal products, and foods, can be removed by the use of charcoal. In European countries it is successfully employed as a fuel to produce motor gas for automobiles, buses, and trucks.

An estimated 350,000 tons of charcoal are produced annually in the United States. Latest figures compiled by the Bureau of the Census show, for an eight-month period, consumption of 339,680 cords of hardwood and softwood in making United States charcoal. See also **CARBON**.

M. EDMUND SPEARE,
Educational Director, Bituminous Coal Institute,
National Coal Association.

CHARCOAL BLACK. See **BLACKS**.

CHARCOAL DRAWING. See **ART DRAWING**.

CHARCOT, shâr-kô', Jean Baptiste Étienne Auguste, French explorer: b. Neuilly-sur-Seine, France, July 15, 1867; d. at sea off Iceland, Sept. 16, 1936. He was an interne at the Hospital of Paris from 1890 to 1894 and was at the same time an investigator at the Pasteur Institute. In 1896-1898 he headed the clinic of the faculty of medicine at the University of Paris. In 1903-1905 and again in 1908-1910 he was leader of expeditions to the Antarctic. He mapped Graham Land and its islands, in 1910 discovered Charcot Land (an island) which he named for his father J. M. Charcot (q.v.). He published official accounts of both expeditions, also "*Pourquoi Pas?*" dans l'*Antarctique* (1912), *Autour du Pôle Sud* (1912), *Christophe Colomb vu par un marin* (1928).

CHARCOT, shâr-kô', Jean Martin, French physician: b. Paris, Nov. 29, 1825; d. Morvan, Aug. 16/18, 1893. He received his medical degree in Paris in 1853 and was appointed to the Central Hospital Bureau. He later became professor of pathological anatomy and in 1862 was connected with Salpêtrière. His specialty was in the treatment of nervous and mental diseases, and he performed many curious and successful experiments in hypnotism and mental suggestion. The name *Charcot's disease* has been applied to cerebrosplinal sclerosis. In 1880 he founded a clinic at the Salpêtrière for the treatment of nervous diseases. His most important work is *Leçons sur les maladies du système nerveux* (1873, Eng. tr. 1877). All his published works, which include treatises on mental disorders, hysteria, and the ills of old age, were collected in *Oeuvres complètes*, 9 vols. (1886-1890).

CHARD, Swiss. See BEET—Swiss Chard.

CHARDIN, shâr-dân', or shâr'din, Jean (later, SIR JOHN CHARDIN), French Oriental traveler: b. Paris, Nov. 26, 1643; d. London, Dec. 25, 1712. Before he had reached his 22d year his father, a jeweler, sent him to the East Indies in order to buy diamonds. Chardin lived six years in Ispahan, where he was less engaged in mercantile business than in profound studies and scientific researches, making use of his connections at court for collecting the most authentic information of the political and military state of Persia. He collected the most valuable materials relating to antiquities and history. In 1670 he returned to France, but again left France for Persia, in 1671, taking with him a considerable quantity of precious stones artistically set, exquisitely worked jewelry, etc. He spent 10 years partly in Persia and partly in India. In 1681 he arrived in London, when he received the honor of knighthood. He published the first volume of his *Journal du Voyage . . . de Chardin en Perse et aux Indes Orientales* (London 1686) which was concurrently followed by an English translation. The other volumes were about to follow, when he was appointed minister plenipotentiary of the king of England to the States-General of Holland and agent of the English East India Company to the same.

In 1711 two editions of his *Travels* appeared in Amsterdam as complete works. He soon after returned to England. The exactness and truth of his statements and the extent of his knowledge, have been confirmed by all succeeding travelers, and have been serviceable to Gibbon, Helvetius, and Montesquieu. The best edition of Chardin's

Travels is that by M. L. Langles in 10 volumes (Paris 1811).

CHARDIN, shâr-dân', Jean Baptiste Siméon, French painter, b. Paris, Nov. 2, 1699; d. there, Dec. 6, 1779. His father was a carpenter. The young Chardin received his first instruction from Pierre Jacques Cazes and had practical experience in executing minor portions of pictures of fashionable painters. His first independent work was a sign for the office of a surgeon. In 1728 on the occasion of a religious procession, he exhibited in the open air two pictures, one of which, *The Skate*, is now in the Louvre. He was already a master of still-life, the genre which was to be his principal occupation throughout his life. He was extremely conscientious, never beginning a new picture until the one preceding it was finished, and unceasingly consulting the object he was representing in order to be sure that his effect was true.

Chardin was twice married, and the fact is not without importance when we consider the character of the man as reflected in his art. He was "good and modest" and the delightful glimpses of family life that he has noted in his pictures are surely a result of the conditions in his own home. Of his two children the son Pierre, gave promise of becoming a painter of merit, but died prematurely at 37 years of age. Chardin was received as a member of the Académie de Peinture in 1728, and became its treasurer in 1755.

In 1757 the king installed Chardin in an apartment in the Louvre where the painter spent the rest of his life. Diderot tells us that Chardin had a great understanding of art and could recognize it in others. The observation is certainly borne out by the fact that he was one of those who voted an encouragement to the young Jacques Louis David, who was to bring in a style of painting so different from his own. He was a wise teacher, Alexandre Evariste Fragonard being a pupil of his before he went to study with François Boucher, and it was to his first master that he owed the best of his instruction. While Chardin's pictures like the exquisite *Pourvoysen* or *Le Bénédicité* at the Louvre and the innumerable still-life pieces might seem at first to suggest the Dutch school, he is in reality akin to the Hollanders only through the fortuitous similarity of his subjects. He is of the Latin tradition and his color and his idea of light—a matter to which he gave great attention—come from the earlier Frenchmen, with their Italian heritage. The composition of Chardin's work is also far removed from the Dutch—though one man of the latter nation must have appeared sympathetic to him, Vermeer of Delft. Even the latter, however, if he is easily Chardin's peer in the matter of light, is not to be placed beside him as a colorist. From the gentle palette, so gay and so harmonious, the best influence has gone forth to the French colorists ever since, and not even Delacroix can make us forget the indebtedness to Chardin of such painters as Cézanne, Renoir, and Matisse. He was very happy in the portrayal of children, as in *Boy Blowing Soap Bubbles* at the Louvre, and the excellent likeness of Rameau d'Alembert and Sedaine. From 1765 to 1769 he painted a series of decorative panels for the

castles of Choisy and Bellevue, of which the *Attributes of the Sciences, Arts and Music* are now in the Louvre. Examples of his work are in Stockholm, Leningrad, Vienna, the Metropolitan Museum in New York, and other museums. The great treasury of it remains in the Louvre.

Consult Pilon, Edmond, *Chardin* (Paris 1909).

CHARDON, shär'd'n, village, Ohio, and seat of Geauga County; altitude 1,230 feet; 25 miles northeast of Cleveland; on the Baltimore and Ohio Railroad. Office supplies, small rubber goods, and maple wood and maple sugar products are manufactured. The Geauga County Maple Festival is held here every spring. Government is by mayor and council. Pop. (1940) 2,001; (1950) 2,478.

CHARDZHOU, chär-jö'öö, city, Turkmen SSR, Asia, in Chardzhou oblast, on the Amu Darya. It is a transportation center. Cotton ginning and milling, silk spinning and karakul processing are the chief industries. Pop. (1939) 54,739.

CHARENTE, shä-ränt', inland department, France, formed chiefly out of the ancient province of Angoumois and deriving its name from the river Charente, by which it is traversed; area, 2,306 square miles; capital, Angoulême. It is in general uneven, with hills covered with chestnut trees, sandy plains, and meadows. The principal rivers are the Charente, joined by the canal of Poitou with the Vienne, Tardoire, Bandiat, Touvre, and Né. The wines of the department are of inferior quality and in little request for the table; but they yield the best brandy in Europe. The celebrated cognac brandy is made in the districts of Champagne, Cognac, Jarnac, Rouillac and Aigre from a grape which yields a white wine. The red wines furnish an inferior brandy, without the bouquet that distinguishes the genuine cognac. The winegrowers themselves carry on the distillation, each estate being furnished with stills and the necessary apparatus. Excepting brandy and paper, the manufactures of the department are inconsiderable, consisting of sack-making, cloth, cordage, hats, corks, naval guns, leather, gunpowder, flour and earthenware. The paper made at Angoulême is said to be the best in France. The department is divided into three arrondissements, Angoulême, Cognac, and Confolens. Pop. (1936) 309,279; (1946) 311,137.

CHARENTE, a river, France, rising in the department of Haute-Vienne; flowing west and emptying into the Bay of Biscay, about 10 miles below Rochefort, opposite the Ile d'Oleron; length, 225 miles. It gives its name to two departments, Charente and Charente-Maritime.

CHARENTE-MARITIME, mä-rë-tëm', until 1941 **CHARENTE-INFÉRIEURE**, än-fä-ryür', department, France, on the west coast, bounded on the north by the department of the Vendée, and on the south by Gironde; area, 2,792 square miles. It comprises parts of the former provinces of Aunis, Saintonge, and Poitou. The principal rivers that traverse or bound the department are the Charente, Gironde, Seudre, Boutonne, and Sèvre-Niortaise—all of which are navigable, as well as the canal of Brouage and that between Niort and Rochelle. The soil is fertile and well cultivated; and a considerable portion planted with vines. The soil produces hemp, flax, saffron, oats, wheat, maize, rye, potatoes, and fruit. The pas-

tures are good and well stocked with cattle, horses and sheep. Along the coast are extensive salt marshes. The industries include the manufacture of salt, brandy, machinery, porcelain and faience ware and oyster and pilchard fisheries. The department is divided into four arrondissements, and the chief harbors are those of Rochefort and La Rochelle; the latter town is the capital of the department. Pop. (1936) 419,021; (1946) 416,187.

CHARENTON-LE-PONT, shä-rän-tôn'l-pôn', commune, France, in the department of Seine; situated about a mile to the southeast of Paris, with which it is connected by rail; at the confluence of the Marne with the Seine. It has numerous mercantile and manufacturing establishments, including boat building, piano making, and porcelain and rubber goods. The stone 10-arched bridge across the Marne used to be considered as the key to Paris on this side; hence the memorable attacks upon it both in the civil wars of France and in those with foreign enemies. Pop. (1946) 21,457.

CHARES, kä'rëz, Athenian general through whose incapacity the Thracian colony was lost to Athens during the Social War in 358-356 B.C., and who exposed his country to the designs of Persia, by entering for mercenary purposes the service of the revolted satrap, Artabazus. Although recalled in disgrace, Chares was sent in 349 to the aid of Olynthus, and again he returned without having achieved anything. In 340 he commanded the army sent to Byzantium against Philip, again gave evidence of his incompetency, was replaced by Phocion, but once more invested with the supreme command. In 338 the fatal issue of the Battle of Chaeronea seems to have been mainly due to his ignorance. He was noted for his athletic figure, his profligacy, and his unscrupulous recklessness.

CHARES, Greek sculptor, a native of Lindus, Rhodes, flourished toward the close of the 3d century B.C. He was a pupil of Lysippus and the sculptor of the Colossus of Rhodes, one of the seven wonders of the world. A representation of the Rhodian sun god erected in commemoration of the successful defense of Rhodes against Demetrius Poliorcetes (305-304 B.C.), the colossus stood about 120 feet high. It was carved about 280 B.C. but later destroyed by earthquake.

CHARGE, in heraldry, one of the bearings. This may be one of the ordinaries, as they are called, the straight line bearings, as fess or chevron or a much more elaborate figure, as the representation of an animal or the head of one. Sometimes the charge is imposed upon another charge.

In *gunnery*, charge signifies the quantity of powder used at one discharge of a gun.

In *military tactics*, charge is the rapid advance of infantry or cavalry against an enemy, with the object of breaking his lines by the momentum of the attack.

CHARGE D'AFFAIRES, shär-zhä' dä-fär', a representative of a country at a less important foreign court, inferior to an ambassador, a minister or resident minister, to whom is entrusted all matters of diplomacy. He is accredited not to the sovereign, but to the minister for foreign affairs of a foreign power,

and he holds his credentials only from the minister for foreign affairs of his own country. The title is also given to the officer placed in charge of an embassy or legation during the temporary absence of the ambassador or minister plenipotentiary.

CHARGE OF THE LIGHT BRIGADE,

The, a celebrated poem by Alfred, Lord Tennyson (q.v.). Written to the meter of Michael Drayton's *Ballad of Agincourt*, it was first published in the *Examiner* in 1854. It appeared in a quarto edition in 1855, and in octavo, under the title *In Honorem*, in the following year. The line "Some one had blundered," deleted in the first edition, was restored in the second edition.

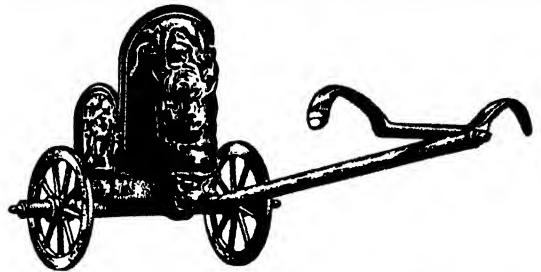
Tennyson drew his inspiration from an account in the London *Times* of the remarkable charge by the Light Brigade at Balaklava on Oct. 25, 1854, during the Crimean War. In the attack on Balaklava by the British and French forces, the Russians had been forced back by the 93d Highlanders. Col. Richard Airey (later Lord Airey), the quartermaster general, then sent Capt. Lewis Edward Nolan, his aide-de-camp, with a written order that the Light Brigade, a cavalry contingent commanded by the 3d earl of Lucan, was to charge along the southern line of heights and drive the Russians from the Turkish batteries. The 7th earl of Cardigan, to whom Lord Lucan transmitted the order, could not see the Russian position from where he was stationed, and believed that he was to advance down the valley in front of him. Nolan was killed just as he perceived the wrong direction the brigade was taking and was endeavoring to set it right. Cardigan headed straight for the Russian guns, "into the jaws of death," and the result was that, of 673 mounted men, 247 were killed or wounded within 20 minutes. The 1st Baron Raglan, British commander in chief, angered at the error and the grave losses sustained, had Lucan recalled.

CHARING CROSS, chār'ing, London, England, a triangular piece of roadway situated at Trafalgar Square. An explanation for the name is that in the 13th century a small village known as Cherringe or Charing was located there. When Eleanor of Castile, queen consort of Edward I, died at Harby, Nottinghamshire, in 1290, her body was brought to Westminster Abbey for burial, accompanied by the king. He erected a memorial cross at each place where the funeral party rested. Charing Cross was the last of probably 12 crosses erected; completed in 1294, it cost £950, with stone from Caen and marble from Dorsetshire. The original cross was destroyed in 1647 by edict of Parliament, and some of the stone is said to have been used to pave Whitehall Palace. A later cross was erected in 1863 in the yard of the Charing Cross Station.

CHARIOT, a vehicle used in ancient times for pleasure or war. In Greek mythology its invention is ascribed to the goddess Athena, while Virgil attributed it to Erichthonius, a mythical king of Athens who is said to have appeared at the Panathenaic Festival in a chariot drawn by four horses. The ancient chariot had only two wheels, which revolved on the axle. The pole was fixed at its lower extremity to the axle, and at the other end was attached to the yoke, either by a pin or by ropes. The Greeks and Romans

seem never to have used more than one pole, but the Lydians had chariots with two or three. In general, the chariot was drawn by two horses. Such was the Roman biga, but we read also of a triga, or three-horse chariot, and a quadriga, or four-horse one.

In ancient warfare chariots were of great importance. The 900 iron chariots of Sisera are described as giving him a great advantage over the



Roman chariot, bronze. Courtesy of Metropolitan Museum of Art.

Israelites (Judges 4:3, 13), and the Philistines had 30,000 chariots in their war against Saul (I Samuel 13:5). The relief sculptures of ancient Egypt show that chariots formed the strength of the army, and there are numbers of representations extant of Assyrian chariots, which resembled the Egyptian ones in all essential features. The earliest depiction of a chariot is on a plaque from Ur, in the museum of the University of Pennsylvania, Philadelphia.

CHARITABLE TRUSTS AND FOUNDATIONS. The foundation is an effective instrument for giving large sums of money. In such newer forms as the community trust and the family foundation, most of its advantages are also available for more modest contributions, or for annual gifts which are expected to grow into a large final amount.

A foundation may be defined as a nongovernmental, nonprofit organization having a principal fund of its own and established to maintain or aid social, educational, charitable, or other activities serving the common welfare. Its predecessors, which were usually endowments for limited purposes, existed from earliest history, at some periods in considerable numbers. The special ingredient which distinguishes the foundation in the American understanding of the name is wide freedom of action. With a very few exceptions, such organizations have arisen only in the United States, and nearly all of them since 1900.

Some legitimate foundations call themselves endowments, trusts, funds, institutions, or boards. On the other hand, because the word "foundation" has acquired an aura of substance and respectability, many organizations use this title with little or no justification. These include agencies which solicit contributions instead of disbursing from an established fund, and some which are trade associations, pressure groups, or outright rackets.

Foundations are a special form of charity, and as such fall under the classic legal definition of Justice Horace Gray (q.v.) in a Massachusetts case of 1867, as a gift to be administered "consistently with existing laws, for the benefit of an indefinite number of persons, either by . . . education or religion, or by relieving their bodies from disease . . . or by assisting them to estab-

lish themselves in life; or by creating or maintaining public buildings or works; or by otherwise lessening the burdens of government."

A variety of legal procedures are available. Some of the earliest foundations were set up by special acts of Congress; among these were the Carnegie Institution of Washington, the Carnegie Foundation for the Advancement of Teaching, and the General Education Board. A few foundations, among them most community trusts, are not incorporated, but operate as charitable trusts under a will, resolution, or instrument of trust. If funds contributed to such a trust are to be tax deductible, they must be committed irrevocably to charitable purposes. Such trusts can be set up within a community trust or in a local bank, thereby freeing the donor from details of investment, accounting, and reporting to the government. These are substantial advantages when the program is not broad enough to warrant the wider freedoms available under the incorporated foundation.

By far the commonest form of organization, however, is incorporation under the laws of a particular state. The laws of incorporation for charitable organizations differ somewhat in the various jurisdictions. The incorporators are usually the original members of the board of trustees (or a part of that board, to be filled out later), and often include the founder. The statement of purpose may be quite specific, or as broad as "the welfare of mankind." In view of many unfortunate experiences with highly restricted perpetuities, the modern tendency has been toward broad statements of purpose, or at least toward the granting of substantial powers to the trustees for effecting changes. In many cases perpetuity is made discretionary, and in some a policy compelling liquidation within a set term of years has been adopted. Many corporate charters, usually to avoid possible question as to their tax-exempt status, follow closely the wording of Section 501(c) (3) of the Internal Revenue Code or similar sections in the laws of their respective states defining a charitable corporation.

Number and Size.—Foundations in the United States probably exceed 5,000 in number, but many of these are small. Russell Sage Foundation's 1950 tabulation of 1,007 larger foundations placed their assets at \$2.6 billion, with an annual expenditure of about \$133 million. Both these figures should be increased because of the creation of additional foundations since that date and the wider information which has become available under compulsory reporting. As of 1953, the assets of the 60 largest foundations totaled \$2.5 billion, with an annual income of \$82 million. It has been estimated that this group holds about half the assets of all foundations, so that total assets of foundations in 1953 might be in the neighborhood of \$4.9 billion.

In the economy of the United States these figures are not large. Americans exhale in tobacco smoke every year more dollars than the accumulated wealth of all the foundations together. But such foundations represent the venture capital of philanthropy, and with their accumulating knowledge of how to give and by applying their funds at strategic places, particularly in research, they have made outstanding contributions in such fields as medicine, public health, education, social welfare, and economic research.

Types of Foundations.—Although few sharp

divisions exist, and not infrequently foundations change in character and program through the years, for purposes of description they may be grouped in the following six main classes.

General Research Foundations.—These foundations have broad charters. They support the research projects in health, welfare, and education which characterize foundation work in the public mind. They include nearly all the larger foundations, and have among them such famous names as the Ford Foundation, Rockefeller Foundation, Carnegie Corporation of New York, and the Commonwealth Fund. Together, they probably account for more than half of all foundation funds.

Special Purpose Foundations.—The trend is away from foundations which are limited, usually by the terms of their charters, to special purposes. Examples, chiefly among older foundations, are the Carnegie Hero Fund Commission and the La Verne Noyes Scholarship Fund. Most such foundations are small, and there is sometimes danger of their special purpose becoming obsolete.

Family or Personal Foundations.—Typically, family foundations are set up by a living person or persons rather than by bequest. The same high tax rates in the upper-income brackets which tend to prevent large accumulations of wealth have encouraged, through the provision for a charitable deduction, the formation of family foundations built up by annual contributions. Generally these foundations are initially small, and have no headquarters other than the office of the donor or of a law firm. They serve as a buffer between the giver and the numerous appeals directed to him, and as a channel through which he and his family can give from varying income, at periods financially convenient. They permit greater leisure for the distribution of gifts, after more adequate investigation and in accordance with a continuing plan. Some of them have served as a means for keeping within a family the control of a tightly held corporation by reducing the founder's taxable estate.

Corporation Foundations.—With the great upsurge of philanthropic giving by corporations, many business companies have organized corporation foundations as a convenient channel for handling their giving and for leveling out contributions between good and bad profit years. It is probable that not fewer than 1,500 such corporation foundations existed in 1953. Though few of them have substantial corpus, serving chiefly as a channel for current giving, some have been able to disburse several million dollars a year. They are a development of great potential importance.

Community Trusts.—These are a special class of foundations concerned with problems of social welfare but acting under community control in a sense seldom found in the usual philanthropic endowment. Most such trusts are organized within a single city, a few bear the name of a county, and several are statewide. Their funds may often be used more widely than their names would suggest; some are applied to international purposes.

These trusts admit separate, named funds, designated for specific purposes. In practically all such trusts, capital gifts or bequests are received and administered as to principal through the trust departments of qualified local banks and trust companies. The income is distributed, to-

gether with such portions of the principal as may be authorized in any trust, under the supervision and control of a distribution committee of citizens selected for their representative character and knowledge of charitable affairs. An important provision is the reservation of power to the distribution committee to transfer to other purposes any funds which can no longer be effectively used for the ends originally designated, thereby avoiding the dangers of rigid perpetuities.

About 100 community trusts are in existence. The National Committee on Community Foundations reported the assets of 94 such trusts at the beginning of 1954 at \$112 million, with disbursements for the preceding year of \$5.6 million.

National Science Foundation.—The only foundation supported out of tax funds is the National Science Foundation, established in 1950, which supports basic research, scholarships, and program coordination in the physical and biological sciences.

Fields of Work.—The humanly appealing causes of direct relief—orphans, widows, crippled children, impoverished age—still attract the funds of many small foundations and of a few larger ones. But most experienced administrators reserve their limited funds for exploratory work directed toward prevention or cure rather than treatment or relief. Discovery is the keynote of their programs—discovery in the physical sciences, discovery in the social sciences, discovery in the application of knowledge already won.

In the Russell Sage Foundation study of 1944, 335 foundations, including almost all the larger ones, reported their fields of substantial interest. Nearly half of them indicated education as a field of major interest, and nearly as many social welfare, which included relief projects. Health, including medical research and medical education, ranked third in number of foundations concentrating in the field, but was probably second in terms of funds expended. All other spheres of activity received far less attention. Recreation was a major interest with 51 foundations, many of them community trusts; 37 specified religion as a major interest; and 26 named international relations and the promotion of peace. Race relations claimed attention from 26. Only 19 were substantially concerned with problems of government and public administration, and the same number—less than 6 per cent— with the whole broad field of economics.

Both this classification and a more detailed examination of projects reveal that there was some concentration on noncontroversial fields. By the early 1950's, however, a pronounced trend was observable on the part of many private foundations away from the older programs centering on relief, routine aid to education, and medical research into the explosive issues of learning to live together in the modern world.

In pursuing these aims, at least three well-defined methods of operation are open to foundations. They may confine their program to the making of grants; they may set up temporary research staffs or experimental projects; or they may maintain a permanent staff for research or service. Most foundations follow the pattern of grant making, confining their professional staff to the persons needed to conduct necessary investigations into the merits of the appeals, handle correspondence, appraise accomplishment, and be the eyes of the foundation, seeking out new op-

portunities for service. But operating programs, or programs combining grants and direct operation, are not uncommon.

Taxation Factors.—High taxation levels have had diverse effects on foundations. Because of the incidence of these taxes few or no personal fortunes are being built up to the dimensions that would permit establishment of such large foundations as the Ford, Carnegie, Rockefeller, or Duke endowments. On the other hand, the tax-exempt status of the foundations themselves attracts contributions from both individuals and corporations in the higher tax brackets, who are able to contribute to foundations of their own choosing or creation at small net cost up to their respective charitable deduction limits. This has resulted in a mushrooming of family and corporation foundations, some of which may grow to substantial size through accumulation of annual additions to their endowment.

Foundations also enjoy exempt status with respect to their own investment income. Prior to 1950 business enterprises which they might conduct were also considered exempt from corporation taxes, since the net profits were dedicated to philanthropic use. A great growth in organizations calling themselves foundations but designed primarily to take advantage of such loopholes in corporate, personal, and estate tax legislation occurred during and after World War II. This was stemmed by the Revenue Act of 1950, which imposes taxes on foundations' unrelated business income, regulates leasebacks, and provides for forfeiture of exempt status if the foundation engages in certain "prohibited transactions" which could benefit the donor or his associates, or if it unreasonably accumulates income; the act also requires public reporting of foundation affairs.

Congressional Investigations.—Foundations, since they enjoy substantial tax and other legal advantages and since their ultimate beneficiary is society itself, are clearly connected with the public interest. The United States Congress has inquired into foundation affairs on various occasions, particularly with respect to taxation, but has conducted only three full-scale investigations, in 1915, 1952, and the Reece Committee investigation beginning in 1953. The 1915 Industrial Relations Commission hearings concentrated on the alleged dangers of foundations as agencies of conservatism and bulwarks of the status quo. The 1952 Select Committee to Investigate Tax-Exempt Foundations and Comparable Organizations (Cox Committee) was charged with just the opposite function; it was to determine "which such foundations and organizations are using their resources for un-American and subversive activities or for purposes not in the interest or tradition of the United States." The published *Hearings* of this committee (see *Bibliography*) constitute a comprehensive source book on the status and activities of United States foundations in the mid-20th century.

The final *Report* of the Cox Committee looked on foundations as "a vital and essential factor in our progress," rendering "great and significant services in many fields." They were not held blameless; mistakes had been made, and some of them were less cautious in their grants than the committee felt desirable. The committee agreed with the foundations that there should be no governmental control of program. Its recommendations were two: fuller public accounting

should be required of all foundations; and the Ways and Means Committee was urged to re-examine pertinent tax laws, with a view to making possible increased "gifts to these meritorious institutions." The Reece Committee had not completed its investigations by mid-1954.

In the light of these findings, and barring major catastrophes of war or finance, United States research foundations, now in their second half century, will continue to be an independent, original, and important force for social progress.

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F. EMERSON ANDREWS,
In Charge of Publications and Philanthropic Research, Russell Sage Foundation; Consultant on Publications, Twentieth Century Fund.

CHARITON, kār'i-tōn, Greek romance writer: fl. not later than 2d century A.D. He identifies himself as a native of Aphrodisias in Caria (southwestern Asia Minor) and secretary to the orator Athenagoras. The earliest of the Greek novelists whose works have survived, he was the author of *Chaereas and Callirhoe*.

In the novel *Chaereas* is represented as a citizen of Syracuse. In a jealous rage he strikes his wife, Callirhoe, injuring her so cruelly that she is supposed dead and in fact is buried. Grave robbers, finding her still alive, take her to Miletus, where they sell her as a slave to Dionysius; she consents to marry her master for the sake of her child by Chaereas.

Meanwhile, Chaereas, hearing she still lives, and filled with remorse, goes in search of her. He himself is captured and enslaved. By a cruel irony his master competes with Dionysius for the love of Callirhoe. They invite the king of Persia to arbitrate, but he too falls a victim to her charms. The news of Egypt's revolt from Persian rule separates the suitors. Chaereas, escaping, joins the Egyptian fleet and leads it to victory over the Persians. He captures a ship containing all the women of the Persian court, including Callirhoe, then sails back to Syracuse with her, and they live happily ever after.

CHARITON, shār'i-t'n, city, Iowa, seat of Lucas County, situated at an altitude of 1,040 feet, on the Chariton River, and on the Burlington and the Chicago, Rock Island and Pacific

railroads, 42 miles south-southeast of Des Moines. The trading center of an agricultural and coal mining region, it has railroad shops and establishments producing brooms, clothing, dairy products, and chemicals. The city has a public library and owns its waterworks and an airport.

Founded in 1849 and incorporated in 1857, Chariton is governed by a mayor and council. Pop. (1950) 5,320.

CHARITY (Fr. *charité*, Lat. *caritas*, high regard, love), one of the seven Christian virtues. In its fullest sense, it is a disposition of mind to love God for Himself alone and mankind for His sake. The word was used in translating the New Testament as a rendering of the Greek *agapē*, meaning "love," and in later versions of the New Testament the latter has been employed instead of "charity," which has come to be used more often in modern English in the sense of charitableness—that is, goodwill to the poor and generosity to worthy causes. In the New Testament, the word charity is never used purely in the sense of almsgiving.

Consideration for the poor and suffering dates back to very early times. In the Old Testament we find such references as those in Deuteronomy 15:7-15, which makes every seventh year a year of liberality to the poor, in which the blessings of God should be shared with those less fortunate; and in Isaiah 58:6, 7, in which a true fast is described as giving food, shelter, and clothing to the poor. Obedience to God and pity for the unfortunate combined to make charity a practice among the ancient Hebrews, and it was emphasized in the Talmud and later Jewish writings.

In ancient Greece the practice of charity grew out of the emphasis placed on hospitality, and there are frequent references in classical Greek literature to the giving of alms to beggars and wayfarers. There was, however, relatively little conception of the religious or ethical connotations of benevolence. In Rome the wealthy made liberal donations to the poor, and public charity, notably in the form of gifts of grain to the urban proletariat, was widespread.

In Hinduism the giving of alms is considered a religious obligation—part of the endeavor to pursue a righteous life. Late Buddhist writings list proper ways of giving alms; if the recipient is worthy, the merit of the gift is increased.

One of the five basic tenets of Islam is the duty to give alms, and *ṣawq*, the dedication of property for religious, pious, or charitable purposes, forms an important part of Moslem law.

Christianity, by its insistence on the worth of each individual, made charity a universal practice. Following the teachings of Christ, as in the Sermon on the Mount, the early Christians emphasized the practice of benevolence toward their fellow men. Contributions were made for the poor of each congregation; later the relief of poverty and suffering was organized on a diocesan scale, and such institutions as hospitals and refuges were established. In the Middle Ages charity was almost entirely the province of the church. Later lay organizations arose, and governments began to assume responsibility for public welfare. See also CHARITABLE TRUSTS AND FOUNDATIONS; CHILD WELFARE; SOCIAL SERVICE.

CHARITY, Brothers of. See ORDERS, RELIGIOUS—Roman Catholic Orders.

CHARITY, Fathers of. See **ORDERS, RELIGIOUS**—*Rosminians*.

CHARITY, Sisters of. See **ORDERS, RELIGIOUS**—*Roman Catholic Orders*.

CHARLEMAGNE, shär'lē-mān (Fr. shär-lē-mān'y; known also as CHARLES THE GREAT and CHARLES I), king of the Franks and emperor of the West: d. Aachen (Aix-la-Chapelle), Germany, Jan. 28, 814. The grandson of Charles Martel and the son of Pepin the Short, he was the second Carolingian king of the Franks and the first Christian emperor of the West. He sprang from a line of Austrasian counts, the Arnulfings or Carolings, who, as mayors of the palace, had first dominated and then replaced the weak Merovingian rulers of the Frankish kingdom. The place of his birth is unknown, but it may have been Aachen, destined to become his capital. The date, too, is uncertain, though the year 742 fits such evidence as we have. According to an important source, he was born out of wedlock, his parents, Pepin and Bertha (the Big-Footed Bertha of later legend), not marrying until he was six or seven years old. He first appears in history at the important ceremony held in St. Denis in 754, at which Pope Stephen III anointed Pepin king of the Franks and associated with him in that act of consecration both Charlemagne and his younger brother Carloman. It was to this crown, given by the Frankish nobles to their elected king and blessed by the head of the Western Church, that Charlemagne and Carloman succeeded as joint heirs when Pepin died on Sept. 24, 768. This division of the kingdom was in accordance with Frankish custom, but it threatened to weaken a state to which Pepin had brought unity and strength. The threat was to vanish with the death of Carloman on Dec. 4, 771.

The weakness became apparent, however, during the three years when each brother reigned in his separate kingdom. They were crowned on the same day, Oct. 9, 768, Charlemagne at Noyon, Carloman at Soissons. Hardly were the ceremonies over when revolt broke out in Aquitania. Charlemagne's first battles had been fought in that restless province, when he accompanied his father on the campaign against Waifer (Gaifier) which ended successfully with the latter's death on June 2, 768. This time, knowing the seriousness of the situation, Charlemagne sought his brother's help. It was refused. Charlemagne marched with his own forces and crushed the revolt unaided.

On his return to Aachen, he found that he was being enmeshed by Carloman and the queen mother in a Lombard alliance. Desiderius, king of the Lombards, was seeking to extend his sovereignty over all Italy, a policy viewed with alarm by the pope. In the process of wooing Frankish goodwill, Desiderius had persuaded Bertha to bring about the marriage of Charlemagne and Carloman with his two daughters and of her own daughter, Gisela, with his son. The sudden death of Carloman, and the union of the two kingdoms under his own scepter, gave Charlemagne the power and the freedom to act decisively. He saw, as Pepin had seen, that to be truly strong the Frankish monarchy needed the support of the pope. He broke with his mother's policy, sent his humiliated wife home to her father, reassured the pope, and led an

army into Italy. In April 774, while Desiderius was blockaded in Pavia, Charlemagne celebrated Easter with Pope Adrian I in Rome. Pavia fell in June. Desiderius was sent off to a monastery, the papal states which he had usurped were restored to the Holy See, and Charlemagne took the title "King of the Franks and Lombards, Patrician of the Romans." King indeed he was, of a strengthened and respected Francia and of a submissive Lombardy. As patrician of the Romans, he became the guarantor of the temporal possessions of the pope in Rome and central Italy. Henceforth in all his enterprises of war or peace, he was to be guided by the twofold purpose of serving at once the interests of his expanding Frankish state and those of the Roman Church.

For long years these policies had to be pursued in war. Already in 772 he had undertaken a successful expedition against the Saxons. These pagan, barbarian, and indomitably hostile tribes occupied the vast region lying between the Rhine and the Elbe. From 774 to 804 a succession of bitter campaigns was fought. The Saxons found a national leader in Wittekind, who severely defeated the Franks in 782 at Sintel; Charlemagne retaliated with a frightful massacre at Verden. In 785, Wittekind submitted and was baptized. The conquest of Saxony seemed to be complete, but war broke out again in 793. Relentlessly, cruelly, using at the last mass deportations, Charlemagne finally crushed Saxon resistance. Christianization went hand in hand with conquest, and a new political and ecclesiastical organization laid the foundations of a future Germany.

In the expanding dominions of Charlemagne, Bavaria, under Duke Tassilo, took on a new strategic importance. Tassilo had sided with Desiderius in the Lombard war. Charlemagne was in no mood to tolerate even his independence. Tassilo made a show of intractability. But he was soon toppled from his throne and, in 794, his domains were incorporated in the Frankish state.

The thrust into Bavaria brought Charlemagne into contact with the Avars, a Turko-Mongol people settled in the region of the middle Danube. Two campaigns were fought against them, the first in 791, the second in 795. In the latter, Duke Eric of Friuli led an Italian army to the heart of the Avar country, captured the fortified encampment of the Ring and took immense booty.

The dates of these many campaigns show that Charlemagne had to fight simultaneously on many fronts. In 778, at the solicitation of Suleiman ibn-al-Arabi, governor of Saragossa, he crossed the Pyrenees, took Pamplona, and reached the walls of Saragossa. But there Suleiman failed him. In the retreat which followed, the Franks were caught in the western passes of the Pyrenees by the Basques, who fell upon them, pillaged their baggage train, and made away with the spoils into their mountain fastnesses. The episode provided the historical nucleus for the old French epic poem, the *Chanson de Roland*. The defeat taught Charlemagne a lesson. His policy henceforth with regard to Spain was defensive. He organized his military defenses in the south under the leadership of Guillaume d'Orange. After an early defeat near Carcassonne in 793, Guillaume carried the war across the Pyrenees. From 798 until 803, cooperating with Louis, the young son whom Charlemagne had made king of

Aquitania, Guillaume methodically went about his business of establishing the Spanish March as a buffer against the might of Moslem Spain, an objective achieved by the capture of Barcelona in 803. Proceeding from the Asturias, a similar effort had established the Western March in Navarre.

But already, in the year 800, a decisive event had taken place. On Christmas Day of that year in St. Peter's Church in Rome, Leo III placed on Charlemagne's head the imperial crown, while the crowd cried in acclamation, "Charlemagne Augustus, Emperor of the Romans!" The act marked at once a culmination and a starting point. Charlemagne had forged the empire of western Europe in the fire of war. As his domains spread, he saw to it that Christian civilization spread with them. In accepting the imperial crown at the hands of the pope, the new emperor accepted the church's consecration of his power. In him, at that moment, the Holy Roman Empire was founded, renovating in western Europe the glory of the old Roman Empire, but incorporating the new principle by which the temporal interests of the emperor and his subjects were identified with the spiritual interests of the pope and his Christian flock. The period of war and conquest was over for Charlemagne. He had now to prove his statesmanship in other ways: to come to an understanding with Byzantium, to clarify his relations with the pope, and to administer his empire.

In his Byzantine policy, Charlemagne moved with circumspection, succeeding finally in 812 in winning the recognition of the Eastern emperor. He faced, in his relations with the pope, the great problem of the Middle Ages, the problem of church and state. He solved it in the main simply by being what he was, a strong and pious emperor, fighting the church's battles in his own. His victories were not won only on the battlefield. In the administration of his vast realm he established a strong, centralized government, organized local affairs in the hands of counts, and exercised continuous supervision by means of his intendants. Justice was reorganized, commerce regularized and stimulated. Under the last Merovingians the intellectual and artistic life of Francia had been almost extinguished. Charlemagne's first concern in this regard was to re-educate the clergy. To make good the lack of scholars, he brought to France learned and renowned teachers from abroad, Alcuin from England, Paulus Diaconus from Italy. With their aid he founded cathedral and monastic schools, and established the seven liberal arts as the general program of studies. The result, not fully apparent until after his death, was a veritable renaissance in letters and in art. His drive toward thoroughgoing reorganization and reform was no less effective in ecclesiastical matters. He set up a whole system of metropolitan archbishoprics having precedence over other sees; he bettered the lot of the humble priest by enforcing the payment of tithes. He brought unity into a disorderly ritual by regularizing the liturgical books. He did not hesitate to take a stand on matters of dogma, inserting the *filioque* in the Nicene Creed despite the opposition of Popes Adrian and Leo, and, at the Council of Frankfurt in 794, denouncing the adoptionism of Bishop Felix of Urgel.

He was mindful, too, of the future. In 806, with what inner misgivings we shall never know,

he divided the empire among his three sons, Charles, Pepin, and Louis. But Pepin died in 810 and Charles in 811, and Louis was acclaimed sole heir in 813. In the following year, on January 28, Charlemagne died.

He lived on, however, in the memory of the Middle Ages as the very embodiment of the ideal Christian emperor. So he appears in the *Chanson de Roland* and in the so-called *Chronicle of Turpin*. It was even written that he had been to the Holy Land, and indeed, his cordial relations with Harun al-Rashid, who allowed him to give pilgrims to Jerusalem every advantage, afforded some historical basis for the tale. The Turpin portrait was carried over into medieval English romance. His name survives in the epic and ballad literature of Spain and in the chivalric romances of Italy. In Germany, where, on Dec. 29, 1165, he was canonized by the antipope Paschal III, he was claimed as the ancestor of the German line of emperors, honored as patron, sung as hero throughout the length and breadth of the land. It was believed in France, about 1300, that he had founded the University of Paris, which adopted him later as its patron saint. The legend of Charlemagne, in which spontaneous admiration mingles with the calculated fictions of interested propaganda, bears witness at once to the glory of his reign and the decadence which followed it. He realized in his personality and achievement a universality of authority which had survived in western Europe as a memory since the collapse of imperial Rome, and which was lost after his death in a welter of warring feudal and national entities.

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RONALD N. WALPOLE.

CHARLEROI or **CHARLEROY**, shâr-lê-rwä', town, Belgium, situated in Hainaut Province, on the Sambre River, 34 miles south of Brussels, with which it is connected by rail and canal. In the center of an area with rich coal deposits, it is almost exclusively a manufacturing town, containing some of the principal iron and steel plants of Belgium. Greater Charleroi formerly comprised 40 communes which grew up around the pit heads and foundries, and it is in these that the heavy industries are located. Third in importance, following coal mining and steel, is the glass industry, which has declined since the 18th and 19th centuries. Other establishments produce machinery, electrical equipment, cement, beer, and flour.

The town, which is built on rising ground on both banks of the river, is the seat of the Université du Travail. It has a 17th century church and chapel, an archaeological museum, and a fine archaeological library.

History.—Little is known of the early history

of Charleroi, originally called Charnoy, beyond brief references in a 9th century manuscript and a 13th century document. Recognized early as a site of strategic importance, the high ground now occupied by the town was fortified in 1006 by Spain, then in possession of what is now Belgium, and the name was changed to Charleroi in honor of the reigning Spanish king, Charles II. The development of Charleroi as a modern town dates from this time. In 1667, when Louis XIV sent 60,000 troops against the Low Countries, the Spaniards destroyed their fortress with mines, but it was immediately rebuilt by the marquis de Vauban.

During World War I, on Aug. 22, 1914, the German Second Army attacked Charleroi, which was the headquarters of the French Fifth Army. The battle raged through the streets until the French were forced to withdraw on the following day [see also WAR, EUROPEAN—*Military Operations on the Western Front* (From the Sambre to the Marne)]. During World War II the town was not defended by the French and Belgian troops, and after scattered bombing it was occupied on May 15, 1940. The enemy occupation lasted four years, during which the outlying industrial communes were bombed by United States and British air forces. In September 1944, the German forces withdrew from Charleroi before the advancing American troops. Pop. (est. 1951) 25,624.

CHARLEROI, shär'lē-roī, borough, Pennsylvania, situated in Washington County, at an altitude of 765 feet, on the navigable Monongahela River and the Pennsylvania Railroad, 22 miles south of Pittsburgh. In a coal mining and agricultural region, it has establishments producing steel, glass, paper boxes, and beverages.

Laid out in 1890 and named for the Belgian glass and iron industrial center, Charleroi was incorporated in 1892. It is governed by a burgess and council. Pop. (1950) 9,872.

CHARLES I (in full CHARLES FRANCIS JOSEPH; Ger. KARL FRANZ JOSEF), emperor of Austria and, as CHARLES IV, king of Hungary: b. Persenbeug, Austria, Aug. 17, 1887; d. Funchal, Madeira, April 1, 1922. Grandson of Charles Louis (q.v.), archduke of Austria (brother of Emperor Francis Joseph), and son of Archduke Otto and of Princess Maria Josepha of Saxony, he married Zita, princess of Bourbon and Parma, in 1911. He became heir apparent to the Austrian and Hungarian thrones on the assassination of his uncle, Archduke Francis Ferdinand, at Sarajevo on June 28, 1914. On the death of Francis Joseph, on Nov. 21, 1916, he succeeded as emperor and king, but abdicated on Nov. 12, 1918, and retired to Switzerland. In March and October 1921, he entered Hungary in unsuccessful attempts to regain the throne. After the second attempt he was exiled by the Allies to Madeira.

CHARLES I, king of Great Britain and Ireland: b. Dunfermline, Scotland, Nov. 19, 1600; d. London, England, Jan. 30, 1649. The second son of James I and Anne of Denmark, he was created duke of York in 1605; in 1612, on the death of his older brother, Prince Henry, he became heir apparent to the throne. He was created prince of Wales in 1616. Little is recorded of him before his romantic journey to

Spain in 1623, in the company of George Villiers, 1st duke of Buckingham, to pay court to the Infanta Maria. Because of religious and political differences the match was prevented, and soon thereafter Charles was betrothed to Henrietta Maria, daughter of Henry IV of France, whom he married after he succeeded his father on the throne in 1625.

The first Parliament which he summoned was dissolved after it had failed to grant him sufficient supplies. By loans and other expedients an expedition was then fitted out against Spain (1626), but it was shattered by a storm. Meanwhile, a new Parliament had been summoned. The distrust prevailing between this assembly and the king laid the foundations for the misfortunes of his reign. Suddenly and angrily he dissolved Parliament after a short session, while the House of Commons was preparing a remonstrance against the levying of tonnage and poundage without the consent of Parliament. He then began to raise funds by means of loans, benevolences, and other procedures, which, though partially sanctioned by precedent, were entirely opposed to the rising spirit of civil liberty and to the constitutional principal which gave control of the public purse to the House of Commons. The king's difficulties were increased by a war with France, in which Buckingham added to the odium against him by an ill-fated expedition to assist the Huguenots of La Rochelle (1627).

In 1628, Charles was obliged to call a third Parliament, which proved to be as much opposed to arbitrary measures as its predecessors, and, after voting supplies, prepared the Petition of Right (q.v.), to which the king was forced to give his assent.

The assassination of Buckingham in August 1628 removed one source of discord, but the Parliament which met in January 1629 showed so determined a spirit against the king's claim of levying tonnage and poundage by his own authority that it was suddenly dissolved. Charles then determined to reign without one, and for this purpose he raised Sir Thomas Wentworth (later 1st earl of Strafford) to the chief place in his councils. In 1629 peace was concluded with France, and in the following year with Spain. In ecclesiastical affairs the king was guided by William Laud, then bishop of London, a strong opponent of Calvinism and Presbyterianism. In Laud's hands the arbitrary Court of High Commission and the Star Chamber were a source of great oppression. To his other expedients for raising funds, Charles added the levying of ship money, at first (1634) from seaports, but in the following year from inland counties as well. John Hampden then began his resistance to the payment of ship money, which he held could not be levied without the authority of Parliament. His cause was argued in 1638, and although he lost the decision, the discussion of the question aroused widespread comment.

It was in Scotland, however, that Charles' opponents first resorted to war. From the beginning of his reign the king had endeavored to introduce into that country a liturgy patterned after that of the Church of England—an innovation which resulted, in 1638, in the formation of the National Covenant, by which great numbers of Scots pledged themselves to stand by each other and resist the imposition of the episcopacy. The Covenanters, as they were called, raised an army, which the king opposed by an ill-discipline

English force, and in 1639 he was forced to agree to the Treaty of Berwick. His finances exhausted after an intermission of 11 years, he again assembled Parliament, in 1640. That body, as usual, began to state grievances before granting supplies, and the king hastily dissolved it and prosecuted several members who had distinguished themselves by their opposition. Raising money by whatever means he could devise, he again sent an army north, but it was defeated by the Scots, and it became obvious that affairs could no longer be managed without Parliament.

That body, which met in November 1640, proved to be the famous Long Parliament (q.v.). It began by impeaching Strafford and Laud (both were subsequently tried under bills of attainder and beheaded, the former in 1641 and the latter in 1645), and then, on Nov. 22, 1641, framed the Grand Remonstrance (q.v.), recapitulating all the king's abuses. In the House of Lords, Charles had his attorney general enter an accusation against five members of the House of Commons who had led in passing the remonstrance, and sent a sergeant at arms to the Commons to demand them. Receiving an evasive answer, he himself proceeded on the following day (Jan. 4, 1642) to the Commons with an armed retinue to seize their persons. Aware of Charles' intention, the five had previously withdrawn, but the king's appearance with a guard caused the Commons to break up in great disorder and indignation. The accused members retired to the City of London, where a committee of the Commons was appointed to sit. The City's militia was mustered under an officer appointed by Parliament, which also demanded control of the army. The queen fled to the Netherlands to procure ammunition, and Charles, with the prince of Wales, went north and for a time resided in York. The king was received with great demonstrations of loyalty from the gentry, and many persons who had hitherto been conscientious opponents of his arbitrary measures now joined his party. The Puritans and the inhabitants of the great trading towns sided with Parliament.

The royal standard was raised at Nottingham on Aug. 22, 1642. The first action of consequence in the ensuing civil war was the Battle of Edge Hill, on Oct. 23, 1642, but nothing decisive occurred until the Battle of Marston Moor (July 2, 1644), in which the Parliamentarians were victorious chiefly because of the skill and valor of Oliver Cromwell. The successes of James Graham, 1st marquess of Montrose, in the Scottish Highlands in 1644-1645 created diversions in favor of the Royalists, but the loss of the Battle of Naseby (June 14, 1645) completed the ruin of the king's cause. Charles at first retired to Oxford, and then, on May 5, 1646, decided to place himself in the hands of the Scottish Army, then at Newark. He was received with respect, though placed under guard. After a series of abortive negotiations an agreement was made with Parliament to surrender him to its commissioners, and, on Jan. 30, 1647, he was accordingly handed over to them. Taken at first to Holmby House in Northamptonshire, he was subsequently moved to the headquarters of the army at Reading, and soon thereafter to Hampton Court. Fearing for his personal safety, the king then escaped with a few attendants and fled to the south coast. Crossing to the Isle of Wight, he put himself in the hands of its governor, Col. Robert Hammond, who lodged him in Carisbrooke Castle.

Meanwhile, the Scots, regretting the manner in which they had delivered Charles to the commissioners and dissatisfied with the measures taken by Parliament, sent a considerable army to the king's relief, under the command of the 2d duke of Hamilton. This force, though strengthened by a large body of English Royalists, was routed by Cromwell at Preston, as were the insurgents in Kent and Essex by Thomas Fairfax (later 2d Baron Fairfax). Fresh negotiations were opened with the king at the Isle of Wight, and he agreed to nearly everything demanded of him except the abolition of the episcopacy. Parliament then accepted the king's concessions as sufficient grounds for a treaty. On its return, however, the triumphant army cleared the Commons by what is known as Pride's Purge (see PRIDE, THOMAS) of all the members opposed to its views (Dec. 6, 1648), and thereby secured a reversal of the decision. The king was taken from the Isle of Wight to Hurst Castle, while preparations were made to try him on a charge of high treason. As the House of Lords refused to concur in a vote for this purpose, the Commons declared its consent unnecessary. Charles was taken to London and brought before a special court of 67 judges on Jan. 20, 1649. His behavior was calm and dignified throughout the trial. He objected three times to the court's authority, supporting his position with cogent arguments. At length, however, he was sentenced to death and, on January 30, was beheaded before Whitehall.

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CHARLES II, king of Great Britain and Ireland: b. London, England, May 29, 1630; d. there, Feb. 6, 1685. The second son of Charles I and Queen Henrietta Maria, he took his seat in the House of Lords in 1640. Two years later he was present at the Battle of Edge Hill, and he resided with his father at Oxford and Bristol. After the Royalist defeat at Naseby (1645), he went to Cornwall and then, in 1646, to the Scilly Isles and Jersey. At his mother's entreaty, he proceeded to Paris, where he remained until 1648. In that year he took part in an expedition which sailed from the Netherlands to the Thames River, where it took some prizes. He then settled in The Hague and made several vain attempts to save his father's life. After the latter was executed, on Jan. 30, 1649, Charles assumed the royal title. Eventually he accepted an invitation from the Scots, who had proclaimed him their king on Feb. 5, 1649, and arrived in Cromarty Firth on June 16, 1650. He signed a declaration in which he made a number of concessions to the Scots. Meanwhile, the army of Oliver Cromwell had entered Scotland; on Sept. 3, 1650, it defeated the Scots at Dunbar. On Jan. 1, 1651, Charles was crowned at Scone; accepting the Covenant, he promised to support Presbyterianism throughout Great Britain. The approach of Cromwell made his stay in Scotland unsafe, and, hoping to find support, he entered England, where he was welcomed at Carlisle. He was immediately pursued by Cromwell, who, with a superior army, won the Battle of Worcester (Sept. 3, 1651). Charles, after a succession of narrow escapes (including the necessity of taking shelter in the celebrated Royal Oak at Boscobel), reached Shoreham, Sussex, and from there fled to France (Oct. 16, 1651). For nine years he remained an exile on the Con-

tinent. (For an account of the events leading to the Restoration, see *GREAT BRITAIN—History*.)

Charles was proclaimed king in London on May 8, 1660, and landed at Dover on May 26. Three days later, he entered his capital, where he was joyfully acclaimed. His first acts as king were prudent and conciliatory. Edward Hyde, 1st earl of Clarendon, was made lord chancellor, and an act of indemnity, from which only those immediately concerned in the death of Charles I were excluded, was passed. A settled revenue was accepted in lieu of wardship and purveyance, and the army was reduced. With regard to religion there was less indulgence; not only were the prelacy and the parliamentary rights of bishops restored, but an Act of Uniformity (1662) was passed, under which nearly all the Presbyterian clergy were forced to resign their livings. In 1662, Charles married Catherine of Braganza, to whom he was flagrantly unfaithful. The extravagance of his way of life soon involved him in financial difficulties, which the unpopular sale of Dunkerque to the French (1662) was undertaken to relieve.

In 1665 a war broke out with the Netherlands. Great Britain at first enjoyed some naval victories, but when France and Denmark entered the conflict as allies of the Dutch, the British were overmatched. A Dutch fleet entered the Thames and, proceeding up the Medway, burned and destroyed ships as far as Chatham (June 13, 1667), and Charles had to conclude peace at Breda. Meanwhile, there were the domestic calamities of a dreadful plague in 1665, and of the Great Fire of London in the following year. In 1667, Clarendon, who had become very unpopular, was dismissed and went into exile. Charles then put himself at the disposition of five unprincipled ministers, known collectively as the Cabal (q.v.). An alliance with the Netherlands and Sweden, for the purpose of checking the ambition of Louis XIV, was concluded in 1668. This policy was reversed, when, on May 20, 1670, there was signed the secret Treaty of Dover, under which Charles agreed to join the French in a war against the Netherlands and to declare himself a Roman Catholic. In return, the king received subsidies from France and thus became a pensioner of Louis XIV. As he did not wish to apply to Parliament for money to carry on the projected war, he had the Exchequer shut up in January 1672. The naval operations of that year against the Dutch were not successful, and when a new Parliament was called (1673), the Cabal was dissolved, and in the following year Great Britain made a separate peace with the Netherlands. Meanwhile, Charles was obliged, under parliamentary pressure, to cancel the Declaration of Indulgence (q.v.), and Parliament passed the Test Act (1673), which resulted in the removal of Roman Catholics from office.

Negotiations for the marriage of the king's niece, Princess Mary, with William of Orange began in 1674. Charles, at first opposed, eventually gave way to popular feeling, and in 1677 the marriage took place. Despite this rapprochement with the Netherlands (the king also was instrumental in arranging the Peace of Nijmegen between France and the Netherlands in 1678), Charles made two further secret treaties with Louis (1676, 1678). The year 1678 was notable for the pretended discovery by Titus Oates (q.v.) of the Popish Plot for the assassination of the king and the introduction of the Roman Catholic

faith. Despite the improbable nature of the pretended plot, the tale of Oates and William Bedloe, supported by general suspicion of the secret influence of a Roman Catholic faction, was widely believed, and many persons were accused and imprisoned. Among those who lost their lives was William Howard, 1st Viscount Stafford. The duke of York (the future James II), a Roman Catholic, was forced to retire to Brussels. In 1679, Parliament passed the Habeas Corpus Act. The king now sought to establish a balance of parties, and from the elections of this period dates the use of the terms Whig and Tory. In 1680 a bill excluding James from succession to the throne was passed by the House of Commons, but it was rejected by the House of Lords. Early in 1681, Charles dissolved Parliament, and a new one was called at Oxford, but it proved so determined to oppose him that he soon dissolved it and, like his father, determined to govern without one.

Shortly after the dissolution of Parliament, the king issued a declaration in which he listed what he considered to be its faults and protested his devotion to Protestantism. This was followed by loyal addresses from all parts of the kingdom, and the king regained some measure of popularity. His brother, who had been recalled from the Continent and made high commissioner of Scotland in 1679, oppressed the Covenanters, and in England the penal laws were strictly enforced against the Nonconformists. An important step in the growth of arbitrary power was the institution of suits (*quo warrantos*) against most of the corporations in the kingdom, by which they were intimidated into resigning their charters, receiving them back in a much more restricted form. Meanwhile, opposition to the king on the part of the extreme Whigs had been growing, and it culminated in 1683 in the celebrated Rye House Plot (q.v.). Besides the actual conspirators, who may have intended the assassination of the king and his brother, many opposition leaders were arrested. Among those executed for their supposed implication in the plot were William Russell and Algernon Sidney. James Scott, duke of Monmouth, the king's illegitimate son (who had been favored as heir to the throne by some of those who had endeavored to exclude James), fled to the Netherlands. The king's health had been poor for several years, and in 1685, shortly after he had suffered a stroke, he died. On his deathbed, he professed himself a Roman Catholic and received the last sacraments of the church.

Consult Clark, G. N., *The Later Stuarts* (London 1934); Bryant, Arthur, *King Charles II*, complete ed. (London 1949).

CHARLES (in full **CHARLES PHILIP ARTHUR GEORGE**), PRINCE (DUKE OF CORNWALL), son of Queen Elizabeth II of Great Britain: b. London, England, Nov. 14, 1948. On the accession of his mother to the British crown on Feb. 6, 1952, he became heir apparent.

CHARLES I, king of France. See **CHARLES II**, Holy Roman emperor.

CHARLES II, king of France. See **CHARLES III**, Holy Roman emperor.

CHARLES III (called **CHARLES THE SIMPLE**), king of France: b. Sept. 17, 879; d. Péronne, France, Oct. 7, 929. He was the posthumous son

of King Louis II (the Stammerer). On his father's death France had been divided between Charles' two brothers, Louis III and Carloman, and when they died in their turn, his extreme youth prevented the recognition of his claims to the throne. Accordingly, his cousin, Charles the Fat, was proclaimed king as Charles II in 884. On the deposition of the latter three years later, Eudes, count of Paris, succeeded in obtaining the crown, but his death in 898 left Charles the Simple undisputed king of the whole country. His reign is noted chiefly for the piratical incursions of the Norsemen or Normans, who ravaged the coasts of France and sailed up the principal rivers. In 911, to put an end to their depredations, Charles ceded to their chief, Rollo, a large part of what came to be called Normandy, to be held as a fief of the French crown. In the same year the king acquired Lorraine. The last years of his reign were disturbed by the turbulence of some of his great vassals, who broke into open rebellion, declared the throne forfeited, and, in 922, proclaimed as king Robert I, count of Paris, brother of Eudes. In the following year, through the treachery of Herbert de Vermandois, Charles was inveigled into the town of Péronne and imprisoned in its fortress, where he remained until his death six years later.

CHARLES IV (called **CHARLES THE FAIR**; Fr. **CHARLES LE BEL**), king of France and, as **CHARLES I**, king of Navarre: b. 1294; d. Vincennes, France, Feb. 1, 1328. The third son of King Philip IV and Jeanne de Navarre, he ascended the throne in 1322 by virtue of the Salic law (q.v.), to the exclusion of the daughter of Philip V. His sister, Isabella of France, married Edward II of England. With her paramour, Roger de Mortimer, she was aided by Charles in fitting out the expedition which resulted in the dethronement of her husband in 1327. In the following year, Charles died without male issue, the last sovereign of the direct line descended from Hugh Capet, and the succession passed to the house of Valois.

CHARLES V (called **CHARLES THE WISE**; Fr. **CHARLES LE SAGE**), king of France: b. Vincennes, France, Jan. 21, 1337; d. Château de Beauté, Fontenay-sous-Bois, Sept. 16, 1380. The son of King John II, he was created duke of Normandy in 1355. In the following year, after the Battle of Poitiers, his father was imprisoned in England, and Charles became regent of France. The kingdom had been misgoverned for years, and the young regent was faced with demands for reform put forth by the States-General, headed by Étienne Marcel, provost of the merchants of Paris. This assembly was supported in its claims by Charles II, king of Navarre, who, as a grandson of King Louis X, claimed the French crown. By temporizing, the regent was able to detach some of the supporters of the States-General and, after he had brought about indirectly the murder of Marcel (1358), succeeded in crushing their party. In the following year a peasants' revolt known as the *Jacquerie* was put down. Meanwhile, King John remained a captive in England until 1360, when he was liberated by the Treaty of Brétigny. Four years later he died, and Charles ascended the throne. The new king re-established the finances of the crown. He was able to hold at bay Charles II of Navarre and, through the great efforts of Bertrand Du Guesclin,

to drive the English forces from south and west France. A patron of literature and art, he assembled the nucleus of the royal library at the Louvre.

CHARLES VI (called **CHARLES THE WELL-BELOVED**; Fr. **CHARLES LE BIEN-AIMÉ**), king of France: b. Paris, France, Dec. 3, 1368; d. there, Oct. 21, 1422. The son of Charles V, he was not 12 years old when his father died, and the rivalry of his uncles, the dukes of Anjou, Berry, Burgundy, and Bourbon, made the period of his minority (1380-1388) one of great turbulence. In 1385 he married Isabeau of Bavaria, and three years later declared himself independent of guardians. His mild and amiable character had won him some popularity with his subjects when, in 1392, he became insane; for the rest of his life he had few lucid intervals. Perhaps at no period in her history was France in a worse condition than during Charles' reign. The rival factions of the Burgundians and the Armagnacs (as the supporters of the houses of Burgundy and Orléans were called, respectively) kept the country in an almost continual state of civil war, and brigandage and violence prevailed. The situation afforded a favorable opportunity for an invasion, and in 1415, King Henry V of England crossed over to Normandy with a substantial force, took Harfleur by storm, and routed the French forces in the Battle of Agincourt. Advancing into the country, he took the capital and compelled the king to sign the Peace of Troyes (1420), by which the latter's daughter, Catherine of Valois, was given in marriage to Henry, and Charles was forced to disinherit his own son (the future Charles VII) and to acknowledge Henry as his successor.

CHARLES VII, king of France: b. Paris, France, Feb. 22, 1403; d. Mehun-sur-Yèvre, July 22, 1461. The fifth son of King Charles VI, he became dauphin in 1417, following the successive deaths of his elder brothers. In 1420, under the terms of the Peace of Troyes, he was disinherited in favor of Henry V of England, and two years later, after the deaths of Henry and Charles VI, Henry's infant son (Henry VI of England) was proclaimed king of France at Paris. With the support of the Armagnacs (adherents of the house of Orléans), Charles was crowned king at Poitiers in 1422. Weak and vacillating, he remained at Bourges, while his supporters fought the English, who were commanded by John of Lancaster, duke of Bedford. So successfully did the duke conduct operations that Charles was almost reduced to abandon the struggle as hopeless when, in 1429, his fortunes were retrieved by the arrival at Bourges of Joan of Arc (q.v.). By the enthusiasm she inspired the tide was turned: the siege of Orléans was raised, and Charles was crowned in Reims Cathedral. The fresh spirit infused in the French was heightened by the mismanagement of the English, whose military operations were much less skillfully conducted after the death, in 1435, of the duke of Bedford. In 1444, through the intervention of William de la Pole, 4th earl of Suffolk, a marriage was arranged between Henry VI and Margaret of Anjou, niece of Charles' queen, Marie (the ceremony took place the following year). Shortly thereafter an Anglo-French truce was arranged at Tours. Peace lasted until 1449, when the English took Fougères. With the resumption of hostilities, Charles' troops were generally successful, and by 1453 they had expelled the English from all their possessions in France

except Calais. The last years of Charles' reign were embittered by domestic difficulties, in which the king's son and successor, the future Louis XI, took a prominent part against his father.

CHARLES VIII, king of France: b. Amboise, France, June 30, 1470; d. there, April 7, 1498. The son of King Louis XI, he succeeded his father in 1483, his sister, Anne de Beaujeu, acting as regent until 1491. In that year he married Anne de Bretagne. Although he thereby acquired Brittany for the French crown, to do so he broke his engagement with Margaret of Austria, daughter of Emperor Maximilian I, and also deprived Maximilian of his bride, a marriage by proxy having previously been arranged between the latter and Anne. The leading event of Charles' reign was his expedition to Italy and conquest of the Kingdom of Naples, a project in which he engaged at the instigation of Lodovico Sforza, the usurping duke of Milan. Charles' pretension to Naples was asserted by virtue of rights transmitted by the house of Anjou to the French royal family. The expedition began in September 1494, when, with an army of 30,000 men, the king suddenly crossed the Alps and entered Italy. After expelling the Medici from Florence, he advanced rapidly southward and, meeting almost no opposition, entered the city of Naples on Feb. 22, 1495. He did not retain his conquest long, however, for a coalition was formed against him, and after he returned to France, in November of that year, a Spanish force under Gonzalo Hernández de Córdoba effected the re-annexation of Naples to Spain. Although Charles' expedition had little immediate effect on Italy, it was significant as the first of a series of French invasions of the peninsula. Moreover, it marked the beginning of important Italian cultural influences on France. Charles, who died at an early age as the result of an accident, left no children, and was succeeded by a distant cousin, the duke of Orléans, under the title of Louis XII.

CHARLES IX, king of France: b. St-Germain-en-Laye, France, June 27, 1550; d. Vincennes, May 30, 1574. The second son of King Henry II and Catherine de' Medici, he ascended the throne in 1560, following the death of his brother, Francis II. His mother forced the retirement of François de Lorraine, 2d duc de Guise, and assumed the regency. The religious conflict, which had been growing in intensity for a number of years in France, broke out into open warfare in 1562, but on March 19, 1563, the Peace of Amboise was signed with the Huguenots. On July 28 of that year, Le Havre was taken from the English, and in 1564 an Anglo-French peace was arranged at Troyes. Charles himself was declared of age in 1563, and the country remained at peace until 1567, when the conflict between Huguenot and Catholic was renewed. After the Battle of St-Denis, in which the Catholic leader, Duc Anne de Montmorency, was killed, another peace was arranged (1568), but a dispute over Huguenot strongholds led to a third war within a few months. Despite the jealousy of Charles, Catherine, who remained the dominant figure of the reign, placed his brother, the duke of Anjou (later Henry III), at the head of the royal army. The Huguenots were defeated at Jarnac and Moncontour in 1569, and in the following year peace was concluded at St-Germain. The terms were fairly favorable to the Huguenots, and what was at

first an uneasy truce seemed likely to develop into real peace with the arrangement of a marriage between the Protestant king of Navarre (later Henry IV of France) and Margaret of Valois, Charles' sister. But the marriage, which took place on Aug. 18, 1572, and drew many Huguenots to Paris, was the prelude to a fourth war. Under Catherine's influence a plot was formed to kill the great Huguenot leader, Admiral Gaspard de Coligny. The first attempt, made on August 22, failed, but much suspicion was aroused, and Catherine and others persuaded Charles to strike at all the Huguenots. On August 24 began what has become known as the Massacre of St. Bartholomew. Coligny and thousands of other Huguenots were killed in Paris and the provinces. (See also SAINT BARTHOLOMEW, MASSACRE OF.) Another peace was arranged in 1573, but a fifth war was in progress when Charles died, without legitimate male heirs, in the following year.

CHARLES X (known until his accession as CHARLES PHILIPPE, COMTE D'ARTOIS), king of France: b. Versailles, France, Oct. 9, 1757; d. Görz, Austria, Nov. 6, 1836. The grandson of Louis XV and son of the Dauphin Louis, he was the younger brother of Louis XVI and Louis XVIII. After the destruction of the Bastille in 1789, he left France as one of the first émigrés, whose leader he became. When Louis XVI accepted the Constitution of 1791, he invited his brother to return, but Charles refused, and the Legislative Assembly, after removing his name from the civil list, confiscated his property in 1792. When war broke out, he acted in conjunction with the Austrian and Prussian armies on the Rhine. In 1795 he participated in an English expedition to Brittany, but soon withdrew and, abandoning the rebels of the Vendée, went to England and then to Scotland, where he lived for several years at Holyrood Palace, Edinburgh. Following the abdication of Napoleon in 1814, Charles returned to France as lieutenant general of the restored kingdom. During the reign of his brother, Louis XVIII, he was the leader of the ultraroyalist party. Succeeding to the throne in 1824, he gained a momentary popularity by abolishing press censorship, but reactionary measures soon followed, and a clash with the liberal elements became inevitable. In an attempt at a coup d'état, the king, on July 25, 1830, promulgated a celebrated series of ordinances, decreeing (1) dissolution of the newly elected Chamber of Deputies; (2) abolition of the freedom of the press; (3) alteration of the electoral laws to favor wealthy citizens; and (4) new elections. A revolution thereupon broke out in Paris, and Charles was driven from the throne. After abdicating formally (August 2) in favor of his grandson, Henri, duc de Bordeaux (later comte de Chambord), Charles went into exile. He revisited England, resumed for a short time his residence at Holyrood Palace, and then went to Prague. His last years were spent in Görz, Austria (now Gorizia, Italy).

CHARLES (called CHARLES THE BOLD; FR. CHARLES LE TÊMÉRAIRE; until his accession, COMTE DE CHAROLAIS), duke of Burgundy: b. Dijon, Burgundy, Nov. 10, 1433; d. Nancy, Lorraine, Jan. 5, 1477. The son of Duke Philip the Good, he became comte de Charolais in 1452, and succeeded his father in 1467. An implacable enemy of Louis XI, Charles joined the League of the

Public Weal (1464-1465) and defeated the king. Immediately after he became duke, he engaged in a war with the citizens of Liège, whom he conquered and treated with extreme harshness. Having been obliged by a rebellion to restore to the citizens of Ghent the privileges taken from them by Philip, he revoked (1469) his concessions, had the leaders of the insurrection executed, and imposed a large fine on the city.

Meanwhile, learning that the people of Liège, instigated by Louis, had rebelled once more (1468), he compelled the king to march with him against the city, which was taken by storm and abandoned to the fury of the soldiers. These successes made the duke inflexible, but as his treatment of his opponents became increasingly severe, the forces which led to his ultimate destruction were aroused.

Charles had married (1468) Margaret, sister of Edward IV of England, and in 1470 he gave the exiled king the money and ships which enabled him to regain his throne. In 1471 the war between the duke and Louis XI was renewed. Charles completed the conquest of Lorraine by taking Nancy in 1475, and then turned against the Swiss. Early in the following year he took the city of Grandson and executed its garrison of 800 men, but this cruelty was soon avenged by the signal victory which the Swiss won nearby on March 2, 1476. After raising a new army, Charles returned to Switzerland, but was defeated once more, at Morat, on June 22. René II, duke of Lorraine, who had fought with the Swiss, led the victors to Nancy, which surrendered to him on October 7. Charles marched to Lorraine, and on Jan. 5, 1477, the two armies met at Nancy. The wings of the Burgundian force were broken through and scattered, and the center, commanded by Charles, was attacked in front and flanked. Beaten and carried along with his retreating army, the duke was thrown from his horse into a ditch, where he was killed by a lance thrust. Although his daughter and heiress, Mary of Burgundy, continued the struggle against Louis XI, she was unsuccessful, and the duchy was annexed to the French crown (1482).

CHARLES (called **CHARLES THE GOOD**; Fr. **CHARLES LE BON**), count of Flanders: b. ?1083; d. Bruges, Flanders, March 2, 1127. The son of King Canute IV of Denmark and Adela, daughter of Robert I, count of Flanders, he was raised in Flanders after Canute's assassination (1086). His cousin, Baldwin VII (d. 1119), willed the countship to him, and after a brief civil war his succession was recognized. He refused the crown of Jerusalem and also the nomination to the imperial crown after the death of Henry V (1125), being content to rule Flanders with justice and clemency. His reign was brought to an untimely close by his murder in the Church of St. Donat, Bruges.

CHARLES I, duke of Lorraine: b. ?950; d. Orléans, France, ?992. The younger son of the Frankish king Louis IV, he was given Lower Lorraine as a duchy by Emperor Otto II in 977. On the death of Louis V (987), the last Carolingian sovereign of France, Charles claimed the crown, for which he fought Hugh Capet. His armies were defeated, however, and he himself was betrayed into Hugh's hands (991) and imprisoned at Orléans, where he remained until his death.

CHARLES II (or **I**; called **CHARLES THE BOLD**), duke of Lorraine: b. 1365; d. Jan. 25, 1431. The son of John I of Lorraine, he succeeded his father as duke in 1391. Neglecting the affairs of his duchy, he spent his life in warfare in Flanders, Hungary, and elsewhere, and was succeeded by René I, king of Naples, husband of his daughter Isabella.

CHARLES III (or **II**; called **CHARLES THE GREAT**), duke of Lorraine: b. Nancy, Lorraine, Feb. 18, 1543; d. there, May 14, 1608. The son of Duke Francis I, he succeeded his father in 1545. From 1552 to 1559 he lived at the court of King Henry II of France, whose daughter Claude he married (1559). Returning to Lorraine in 1560, he devoted himself to the welfare of his territory. He established several new towns and built a number of imposing structures in Nancy. As a member of the Holy League, he was an active participant in the French religious wars.

CHARLES IV (or **III**), duke of Lorraine: b. Nancy, Lorraine, April 5, 1604; d. Sept. 18, 1675. The son of Duke Francis II, he succeeded to the duchy on his father's abdication in 1624, and obtained the Duchy of Bar through marriage with his cousin, Nicole. Forced to abdicate by Armand Cardinal de Richelieu in 1634, he entered the service of Emperor Ferdinand III, for whom he fought at Nördlingen. His duchies were restored in 1641, but were seized again three years later. After the Peace of Westphalia (1648), Charles entered Spanish service. Subsequently he fought for the Fronde (q.v.). Because of various intrigues he was imprisoned by the Spanish from 1654 to 1659, when his duchies were restored once more. He lost them 10 years later, however, and died in exile.

CHARLES V (or **IV**; also known as **CHARLES LEOPOLD**), duke of Lorraine: b. Vienna, Austria, April 3, 1643; d. Wels, Austria, April 18, 1690. The nephew and heir of Duke Charles IV, he attempted to occupy Lorraine on his uncle's death (1675), but was unsuccessful in a two-year struggle against the forces of Louis XIV of France, and despite years of negotiation never obtained his duchy. Turning to a military career, he became a general and later a field marshal in imperial service. In 1683, with King John III Sobieski of Poland, he broke the Turkish siege of Vienna, and four years later he defeated the Turks decisively in the Second Battle of Mohács (actually fought at Harkány, Hungary). In the War of the Palatinate, which began in 1688, Charles was in command of the imperial forces fighting Louis XIV, but he died while on his way from Vienna to the front.

CHARLES (in full **CHARLES ALEXANDER**; Ger. **KARL ALEXANDER**), prince of Lorraine: b. Lunéville, Lorraine, Dec. 12, 1712; d. Tervueren, Austrian Netherlands, July 4, 1780. The youngest son of Duke Leopold of Lorraine and grandson of Duke Charles V, he was trained for a military career. He fought the Turks in 1738-1739, and in the following year, at the outbreak of the First Silesian War, was made a field marshal by Maria Theresa of Austria, wife of his brother, Duke Francis Stephen (later Emperor Francis I). Although he distinguished himself as a military commander, Charles was defeated by Frederick the Great of Prussia at Chotusitz (1742). In

1744 he married Maria Ann of Austria, sister of Maria Theresa, who made the couple joint governors general of the Austrian Netherlands (now Belgium). When the Second Silesian War (1744-1745) broke out, Charles made a brilliant crossing of the Rhine and invaded Lorraine, but was forced to withdraw in order to march against Frederick in Silesia. After expelling the Prussians from Bohemia, he was defeated by them (1745) at Hohenfriedberg and Soor. In the following year, as commander in the Netherlands, he was defeated by Marshal Saxe at Rocourt. Recalled to military duty in the Seven Years' War, he defeated the Prussians at Breslau in 1757, but was in turn crushingly defeated by Frederick at Leuthen later that year. Relieved of his command, he served as military adviser in Vienna until 1763, when he was reappointed governor general at Brussels, serving in this post until his death. Charles introduced many reforms in the government of the Austrian Netherlands, and did much to aid the welfare of the people there.

CHARLES, the name of seven rulers of Germany. See CHARLES I to CHARLES VII, Holy Roman emperors.

CHARLES (Ger. KARL), grand duke of Baden: b. Karlsruhe, Baden, June 8, 1786; d. Rastatt, Dec. 8, 1818. The grandson and successor of Grand Duke Charles Frederick (d. 1811), he aided Napoleon, whose adopted daughter, Stéphanie de Beauharnais, he married in 1806. After the French defeat at Leipzig in 1813, Charles sided with the Allies, and two years later he made Baden a member of the Germanic Confederation. In 1818, shortly before his death, he granted a liberal constitution to the grand duchy.

CHARLES, the name of two grand dukes of Mecklenburg-Strelitz.

CHARLES (in full CHARLES LOUIS FREDERICK; 1741-1816) served as governor of Hannover from 1776 to 1786, and six years later became duke of Mecklenburg-Strelitz. He joined the Allied coalition against Napoleon, and in 1815 his duchy was made a grand duchy.

CHARLES (in full CHARLES FREDERICK AUGUSTUS; 1785-1837), son of the preceding, distinguished himself as an officer in the Prussian Army in the wars against Napoleon. He succeeded his father as grand duke in 1816, but remained in Prussian service, rising to the rank of general in 1825, and becoming president of the Council of State in Berlin two years later.

CHARLES I (in full CHARLES FREDERICK ALEXANDER), king of Württemberg: b. Stuttgart, Württemberg, March 6, 1823; d. there, Oct. 6, 1891. The only son of King William I of Württemberg, he married Grand Duchess Olga, daughter of Nicholas I of Russia, in 1846, and succeeded his father as king in 1864. He sided with Austria against Prussia in 1866, but joined the other German states in the Franco-Prussian War in 1870. During his reign a number of reforms were introduced in Württemberg.

CHARLES, the name of two dukes of Württemberg.

CHARLES (I) ALEXANDER (1684-1737) served in the Austrian Army during the War of the Spanish Succession, and against the Turks in 1716-1718. He succeeded to the duchy in 1733.

CHARLES (II) EUGENE (1728-1793), son of the preceding, succeeded his father as duke in 1737, and was declared of age seven years later. His long reign was generally tyrannical. He founded the Karlschule (later known as the Akademie) in Stuttgart.

CHARLES I, Holy Roman emperor. See CHARLEMAGNE.

CHARLES II (called CHARLES THE BALD; Fr. CHARLES LE CHAUVÉ), Holy Roman emperor and, as CHARLES I, king of France: b. Frankfurt am Main, Germany, June 13, 823; d. Brides-les-Bains, France, Oct. 6, 877. He was the son of Emperor Louis I and his second wife, Judith of Bavaria. Before his birth his father had divided the empire, to take effect after his death, among his three elder sons, Pepin (Pepin I, king of Aquitaine, d. 838), Lothair (Emperor Lothair I), and Louis (Louis II, king of Germany). The redivision of the inheritance to provide a share for Charles provoked a civil war in 838. On Louis I's death, in 840, Charles became king of what is now France, but he found himself confronted with two enemies—Lothair, who, as eldest son, claimed the whole of the Frankish empire of Charlemagne; and Pepin's son, Pepin II, who asserted his right to inherit his father's sovereignty over Aquitaine. With the aid of his half brother Louis, Charles defeated Lothair and Pepin at Fontenoy, France, in 841. Two years later, by the Treaty of Verdun, the empire was divided among the three brothers, Louis receiving Germany; Lothair, Lotharingia (Lorraine) and Italy; and Charles, most of what is now France. (Pepin II was dispossessed by the treaty. Though reinstated as king of Aquitaine in 845, he was again dispossessed in 850.) As king of France, Charles was faced by constant raids by the Normans, who sacked Bordeaux, Rouen, Orléans, and part of Paris. In 875, on the death of his nephew, Emperor Louis II (son and successor of Lothair), Charles invaded Italy and had himself crowned emperor and, in the following year, king of Italy. He thereby provoked the hostility of his brother, Louis II of Germany, who ravaged Champagne. Charles' death occurred while he was returning from an abortive expedition to Italy to aid Pope John VIII against the Saracens.

CHARLES III (called CHARLES THE FAT; Fr. CHARLES LE GROS), Holy Roman emperor and, as CHARLES II, king of France: b. 839; d. Neudingen, near Donaueschingen, Germany, Jan. 13, 888. The son of King Louis II of Germany, he was king of part of Germany from 876 to 887. In 881 he was crowned emperor by Pope John VIII, and three years later he ascended the French throne, the rights of his cousin, Charles the Simple (later King Charles III), not being recognized because of his youth. In 886, Charles the Fat was forced to sign a treaty with the Normans, and in the following year he was deposed by Arnulf, who became emperor, while Eudes, count of Paris, became king of France.

CHARLES IV (known also as CHARLES OF LUXEMBURG), Holy Roman emperor: b. Prague, Bohemia, May 14, 1316; d. there, Nov. 29, 1378. The son of John of Luxembourg, king of Bohemia, he spent his youth in France, where his father aided King Charles IV and Philip VI, and he

fought at the Battle of Crécy (1346). His father was killed in that battle, and Charles inherited the Kingdom of Bohemia. In 1346, by agreement with Pope Clement VI, he was chosen emperor by five electors to succeed the deposed Louis IV, and he hoped to occupy the imperial throne without opposition. Louis fought against him, however, and the princes of the empire regarded Charles as a servant of the pope. Even after Louis' death (1347) he encountered opposition, but his marriage to Anna, daughter of Rudolf, count of the Palatinate, and various concessions to his enemies paved the way for his unanimous election as emperor and his coronation at Aachen in 1349. In 1354, Charles went to Italy, where he virtually abandoned all imperial claims. After his coronation as king of Italy at Milan (1355), he confirmed the Visconti in their possessions, and he annulled the acts of his grandfather, Emperor Henry VII, against Florence. He received the imperial crown at Rome (1355), and, refusing the request of some Romans to claim the city, renounced all sovereignty over Rome, the Papal States, Naples, Sicily, Sardinia, and Corsica. Returning to Germany in 1356, Charles issued the celebrated Golden Bull (q.v.) at Nurnberg. In 1365 he was crowned king of Burgundy at Arles.

In general, Charles neglected the empire, preferring to increase the power and prestige of Bohemia, which attained a high degree of prosperity under his rule. He rebuilt and embellished the city of Prague, published a new code of laws for the kingdom, and, in 1348, founded the University of Prague. Meanwhile, there was considerable unrest in other parts of the empire. Despite the emperor's opposition, the towns and cities of Swabia formed the Swabian League for their protection. The reign was marred by a terrible persecution of the Jews.

CHARLES V, Holy Roman emperor and, as CHARLES I, king of Spain: b. Ghent, Flanders, Feb. 24, 1500; d. San Jerónimo de Yuste, near Plasencia, Spain, Sept. 21, 1558. The son of Philip of Burgundy (later Philip I of Castile), and the grandson of Emperor Maximilian I and of Ferdinand and Isabella of Spain, he inherited Burgundy and the Netherlands on the death of his father in 1506. He was educated in Flanders under the care of Guillaume de Croy, seigneur de Chièvres. On the death of Ferdinand in 1516, Charles became King of Spain, Francisco Cardinal Jiménez de Cisneros serving as regent until the young monarch's arrival in the peninsula in the following year. On the death of Maximilian in 1519, Charles was elected emperor, and he left Spain to take possession of his new dignity, for which he had to contend with King Francis I of France. His coronation took place at Aachen in 1520. Germany was then in the midst of the Reformation, and in the following year the emperor held a Diet at Worms, at which Martin Luther appeared, with a safe-conduct from Charles, and defended his cause with energy and boldness. Charles kept silent, but after Luther's departure the Edict of Worms, outlawing the reformer and his followers, was issued. Meanwhile, during Charles' absence, several revolts were put down in Spain: that of the *comuneros* (commoners or townsmen) in 1521; that of the *germanías* in 1523; and that of the Moriscos in 1525.

Within a few years the growing power of Charles had become a source of uneasiness to most other European rulers. In 1526, Pope Clem-

ent VII placed himself at the head of a league of the principal Italian states against the emperor (Holy League of Cognac). Imperial troops under Constable Bourbon (Duc Charles de Bourbon) took Rome by storm in 1527, sacked the city, and made the pope himself prisoner. Henry VIII of England now allied himself with Francis against Charles, who accused the French monarch of having broken his word. The war was terminated in 1529 by the Peace of Cambrai, under conditions favorable to the emperor. In the following year, Charles was crowned king of Lombardy and Roman emperor by the pope at Bologna. At the Diet of Augsburg (1530), he seemed desirous of reconciling the various parties, but, failing to do so, issued a decree against the Protestants, which they countered by the formation of the League of Schmalkalden in 1531. In general, however, Charles practiced moderation toward the Protestants of Germany, and the Protestant rulers furnished contingents when he assembled an army against the Turks. Having compelled Sultan Suleiman I to retreat in 1532, he undertook in 1535 an expedition against the pirates of Tunis, reinstated the dey, and released 20,000 Christian slaves.

Charles' policy was to reconcile the two great religious parties, and to this end he alternately threatened and courted the Protestants. After negotiations failed, however, the Schmalkaldic War broke out in 1546. The emperor declared the heads of the league under the ban of the empire, raised an army, and obtained an early advantage over his enemies. John Frederick, the elector of Saxony, was taken prisoner at the Battle of Mühlberg (1547), and he saved his life only by renouncing his electorate and his hereditary estates, but remained a prisoner. Another Protestant leader, Philip the Magnanimous, landgrave of Hesse, was also deprived of his freedom. After dissolving the League of Schmalkalden, Charles again occupied himself with his plan for uniting all religious parties, and for this purpose issued the Augsburg Interim (1548), which proved as fruitless as the measures he had proposed at the Diet of Augsburg. Neither was he successful in securing the imperial crown for his son, Philip. Moreover, in 1551, Maurice, duke of Saxony, whom Charles had made elector, formed a league, which was joined by Henry II of France, Francis' successor. At this time, Charles was superintending the deliberations of the Council of Trent and formulating plans for war against France and the Turks. He was expecting the aid of Maurice, when that prince suddenly appeared at the head of an army (1552) and invaded the Tirol, while Henry entered Lorraine. The emperor was nearly surprised at Innsbruck. The Council of Trent was adjourned, and the Protestants were able to dictate the conditions of the Treaty of Passau (1552). John Frederick and Philip the Magnanimous were freed. Charles was not more successful in Lorraine. He was unable to recover Metz, which was defended by François de Lorraine, 2d duc de Guise. In Italy he lost Siena by a revolt. He withdrew to Brussels, where for several months he lived in seclusion, so that the report of his death was spread over Europe. His last efforts were made against France, which constantly repelled his assaults. The Peace of Augsburg (1555) confirmed the Treaty of Passau, and gave Protestants equal rights with Roman Catholics.

Charles, seeing all his plans frustrated, resolved to transfer his hereditary estates to Philip

(later King Philip II of Spain). In 1554 he relinquished Naples to his son, and in the following year, at a meeting of the Estates of the Netherlands at Louvain, he conferred on Philip the sovereignty over the Netherlands as well. He relinquished the imperial crown to his brother, Frederick I, in 1556, and in the same year abdicated as king of Spain in favor of Philip. Reserving for himself a pension of 100,000 ducats, he retired in 1557 to the Monastery of San Jerónimo de Yuste in Extremadura, where he lived a life of religious devotion until his death.

Consult Merriman, R. B., *The Rise of the Spanish Empire in the Old World and the New*; vol. 1, *The Empire* (New York 1925); Lewis, D. B. W., *Charles of Europe* (London 1935); McElwee, W. L., *Reign of Charles V, 1516-1558* (New York 1936); Brandt, Karl, *Emperor Charles V* (New York 1939).

CHARLES VI, Holy Roman emperor and, as **CHARLES III**, king of Hungary: b. Vienna, Austria, Oct. 1, 1685; d. there, Oct. 20, 1740. The second son of Emperor Leopold I, he was destined by his father for the Spanish throne. The last Habsburg king of Spain, Charles II, had no children, and there were several candidates to succeed him. Disregarding the claims of the Austrian Habsburgs, he made a will naming as his heir Philip, duke of Anjou, grandson of King Louis XIV of France. When Charles II died, on Nov. 1, 1700, Philip accordingly took possession of the vacant throne, with the title of Philip V. In the war which followed, known as the War of the Spanish Succession (see **SUCCESSION WARS**), Philip was supported only by France, while England and Holland united against him in an alliance soon joined by Prussia, Portugal, and Savoy. Charles was proclaimed king of Spain at Vienna in 1703. In January of the following year, with 12,000 men, he sailed from England to Spain, which was almost wholly occupied by the French. Landing in Catalonia, he made himself master of Barcelona, but was soon besieged there by Philip. With a small garrison he held out until a long-expected English fleet appeared, compelling the French to raise the siege. In the ensuing struggle for Spain, Charles met with alternate reverses and successes. Twice he reached Madrid, and twice he was driven from the city. On the first occasion, in 1706, he had himself proclaimed king under the title Charles III. In 1711, after he had been compelled for a second time to retreat to the walls of Barcelona, he learned of the death of his brother, Emperor Joseph I, and of his own succession to the Austrian and Hungarian dominions. Returning to Germany, he was informed that, at the suggestion of Eugene, prince of Savoy, he had also been elected emperor. His coronation took place at Frankfurt am Main in December 1711, and in the following year he received, at Pressburg (now Bratislava), the crown of Hungary. At the same time, despite the growing coolness of his allies (who did not like to see so much power united in the same hands), he retained the empty title of king of Spain. He continued to prosecute the war, but he was unable to prevent the allies from concluding a peace with France at Utrecht in 1713, and in the following year he was obliged to sign the Treaty of Rastatt. By this treaty he was confirmed in the possession of Naples, Milan, Sardinia, and the former Spanish Netherlands. Meanwhile, in 1713, to secure the succession to his dominions of his daughter, Maria Theresa, in default of male heirs, he issued the Pragmatic

Sanction (q.v.), which he induced the powers to guarantee.

When, in 1733, the succession to the Polish throne was disputed following the death of Augustus II, Charles, with Russia, supported the claims of Augustus' son, while France and Spain declared themselves for Stanislas I Leszczyński. The ensuing War of the Polish Succession, which lasted until 1735, resulted in the Austrian loss of the Two Sicilies and part of the Duchy of Milan. Austria received Tuscany in exchange for Lorraine, and obtained Parma. Two years later, Charles' alliance with Russia involved him in a war with the Turks. His troops invaded Serbia without a declaration of war, and occupied Niš. The Turks increased their forces, however, and obliged the emperor, after three unsuccessful campaigns, to sign the Treaty of Belgrade (1739), whereby Charles ceded to them Walachia and the Austrian portion of Serbia, with Belgrade.

CHARLES VII (**CHARLES ALBERT**; Ger. **KARL ALBRECHT**; known also as **CHARLES OF BAVARIA**), Holy Roman emperor: b. Brussels, Spanish Netherlands, Aug. 6, 1697; d. Munich, Bavaria, Jan. 20, 1745. He was the son of Maximilian II Emanuel, elector of Bavaria, who, at the time of Charles' birth, was governor of the Spanish Netherlands. His youth was spent at the imperial court, and in the war against the Turks (1714-1718) he commanded an army of auxiliaries sent by his father. In 1722 he married Maria Amelia, daughter of Emperor Joseph I, having previously renounced (with mental reservations) all rights which this marriage might give him to the succession to the Austrian throne. Four years later he succeeded his father as elector of Bavaria. Charles was one of the princes who protested against the Pragmatic Sanction (q.v.), guaranteed in 1732 by the Diet of Regensburg, and in consequence he concluded a defensive alliance with Saxony. After the death of Emperor Charles VI in 1740, he refused to acknowledge Maria Theresa as heir of the Habsburg dominions, founding his own claims to the succession on a will of Ferdinand I. In the ensuing War of the Austrian Succession (see **SUCCESSION WARS**), Charles was supported by France, and in 1741 he was recognized at Linz as archduke of Austria. The obstacles placed in his path by André Hercule Cardinal de Fleury, who did not wish the Austrian monarchy dismembered, as well as want of artillery and ammunition, prevented Charles from gaining possession of Vienna. He was able to take Prague (1741), however, and there he was crowned and proclaimed king of Bohemia. In the following year he was unanimously elected Holy Roman emperor and made a solemn entry into Frankfurt am Main, where he was crowned by his brother, Clement, archbishop of Cologne. This was the high point of Charles' fortunes, for the armies of Maria Theresa soon reconquered Upper Austria and overran Bavaria. Charles was forced to abandon Bohemia, and he fled to Frankfurt. An attack by Prussia on Maria Theresa permitted Charles to return to Munich in 1744. He was succeeded in the electorate by his son, Maximilian III Joseph.

CHARLES I (known also as **CHARLES ROBERT OF ANJOU** and **CAROBERT**), king of Hungary: b. 1288; d. July 16, 1342. The grandson of King Charles II of Naples, he claimed the crown of Hungary as the great-grandson of Stephen V.

After being crowned at Esztergom in 1301, however, he was forced to surrender the crown to Wenceslaus III of Bohemia. With the aid of Pope Boniface VIII, he determined to recover the crown, and in 1308 he was elected king by the Hungarian Diet. On June 15, 1309, he was enthroned at Buda, but his installation was not regarded as valid until he was crowned with the sacred crown of St. Stephen on Aug. 27, 1310. For the next two years he was faced with constant rebellions, finally defeating the rebels and establishing his authority at the Battle of Rozgony (June 15, 1312).

The founder of the Anjou line of Hungary, Charles established the power of the Hungarian royal house on a feudal basis. He encouraged trade, increased the privileges of the towns, imposed direct taxes, and raised Hungary to the rank of a major power, while at the same time enriching and civilizing the country. His successful ventures in foreign affairs culminated in 1339 in his marriage to Elizabeth, daughter of Ladislas I king of Poland, eventual succession to the Polish throne being secured to the son of this marriage, Louis I.

CHARLES II (known as **CHARLES OF DURAZZO**), king of Hungary. See **CHARLES III**, king of Naples.

CHARLES III, king of Hungary. See **CHARLES VI**, Holy Roman emperor.

CHARLES IV, king of Hungary. See **CHARLES I**, emperor of Austria.

CHARLES I (known as **CHARLES OF ANJOU**), king of Naples and Sicily: b. 1226; d. Foggia, Italy, Jan. 7, 1285. The son of King Louis VIII of France, he became count of Anjou and of Provence in 1246. Two years later, he accompanied his elder brother, Louis IX, on the Seventh Crusade, returning to France in 1250. With papal backing, he waged war on Manfred, king of the Two Sicilies, who was the leader of the Ghibelline faction in Italy, and in 1266 defeated him at the Battle of Benevento. Manfred was killed, and Charles succeeded him as king of Naples and Sicily. Two years later, Charles defeated and beheaded Manfred's nephew, Conradin, thereby removing the last open opposition to his rule. The reign of Charles in Sicily was marked by such cruelty that the French became universally detested on the island. Finally, on March 31, 1282, the Sicilians rose in arms and killed all the French in the town and neighborhood of Palermo. The signal for the rising was the tolling of the vesper bell, and the massacre is known in history as the Sicilian Vespers (q.v.). Two years later, Charles was driven from Sicily by Pedro III of Aragon, and he was unsuccessful in several attempts to regain the island.

CHARLES II (sometimes known as **CHARLES OF ANJOU**), king of Naples: b. 1246; d. Naples, Italy, May 5, 1309. The son of King Charles I of Naples and Sicily, he was captured by Pedro III of Aragon in a naval battle at Naples in 1284. In the following year, while still a prisoner, he succeeded to the throne of the Two Sicilies. King Edward I of England negotiated a peace in 1287, and in the following year Charles was released to become king of Naples only. With the aid of Pope Nicholas IV, he attempted to regain

Sicily, but the death of Alfonso III of Aragon (1291) and of the pope (1292) changed the situation. The new pope, Boniface VIII, attempted mediation and succeeded in negotiating a treaty. King Frederick II of Sicily refused to agree to the treaty, however, and was supported in his stand by his people. In the furious land and sea war (1296-1302) which followed, Charles was aided by his sons-in-law, Charles de Valois and James II of Aragon, but was unable to reconquer the island. In 1302 a new treaty was signed at Caltabellotta. By its terms, Charles relinquished his claims to Sicily, and he also gave his daughter, Leonora, in marriage to Frederick.

CHARLES III (known as **CHARLES OF DURAZZO** and **CHARLES OF ANJOU**), king of Naples and, as **CHARLES II**, king of Hungary: b. 1345; d. near Buda, Hungary, Feb. 17, 1386. The great-grandson of Charles II of Naples, he was adopted by Queen Joanna I, but was subsequently replaced in her favor by Louis I of Anjou. In 1381 he seized the crown of Naples. A year later he caused the death of his adopted mother, and from 1382 to 1384 he fought Louis. Crowned king of Hungary in 1385, he was soon faced by a rebellion. Taken prisoner, he was poisoned.

CHARLES IV, king of Naples and Sicily. See **CHARLES III**, king of Spain.

CHARLES, the name of three dukes of Parma of the Italian Bourbon line.

CHARLES I. See **CHARLES III**, king of Spain.
CHARLES II (in full **CHARLES LOUIS FERDINAND DE BOURBON**; 1799-1883), son of Louis de Bourbon, king of Etruria, and of Maria Luisa, daughter of King Charles IV of Spain, became duke of Parma in 1803. Four years later his abdication was forced by Napoleon. The Congress of Vienna gave Parma to Maria Louise, wife of Napoleon, and awarded the Duchy of Lucca to Maria Luisa, who served as regent for her son until her death in 1824. As duke of Lucca, Charles was at first a liberal ruler, but eventually he became eccentric and reactionary. On the death of Marie Louise in 1847, he was restored as duke of Parma, and he sold his interest in Lucca to Tuscany. When the revolutionary movement of 1848 reached Parma, Charles was forced to abdicate. This step was confirmed in 1849, and he retired to France.

CHARLES III (in full **CHARLES FERDINAND DE BOURBON**; 1823-1854), son of Charles II, placed Parma under martial law immediately after his accession, which followed his father's abdication in 1849. He closed the university and embarked on a policy of repression and persecution of liberal elements. A drunkard and a libertine, he died by assassination.

CHARLES I, king of Spain. See **CHARLES V**, Holy Roman emperor.

CHARLES II, king of Spain: b. Madrid, Spain, Nov. 11, 1661; d. there, Nov. 1, 1700. The son of King Philip IV and Mariana de Austria, he succeeded his father in 1665, his mother serving as regent until 1675. In this reign, Spain, which for nearly three centuries had been a leading European power, declined rapidly in influence and prestige. The king was a puppet alternately in the hands of the French and Austrian factions at his court, and the three wars which Spain

fought with France were a drain on the country's resources. Shortly before his death, Charles named as his successor Philip, duke of Anjou, grandson of Louis XIV of France, an act which led to the long and calamitous War of the Spanish Succession.

CHARLES III (known in his youth as **DON CARLOS OF BOURBON**), king of Spain and, as **CHARLES I**, duke of Parma, and **CHARLES IV**, king of the Two Sicilies (Naples and Sicily): b. Madrid, Spain, Jan. 20, 1716; d. Dec. 14, 1788. The elder son of King Philip V and his second wife, Elizabeth Farnese of Parma, he received Parma and Piacenza in 1731, with the title of duke of Parma. Three years later, with French support, he conquered the Two Sicilies and was proclaimed king. The first of the Neapolitan Bourbons, he reigned as Charles IV. (In the following year he renounced his rights in Parma and Piacenza to Austria, a decision confirmed by the Treaty of Vienna in 1738.) As ruler of the Two Sicilies, he began the program of internal reform which he would continue in Spain. On the death of his half brother, Ferdinand VI, in 1759, Charles became king of Spain and resigned the Two Sicilies to his third son, Ferdinand I. Two years later he signed the Third Family Compact with France, a step which, by drawing Spain into the Seven Years' War, resulted in the loss of Menorca and Florida under the terms of the Treaty of Paris (1763). He came close to warring with Great Britain over the Falkland Islands in 1771, and in 1779 joined France in alliance with the United States against Britain. By the Treaty of Versailles (1783), Spain recovered Menorca and Florida.

An ardent Francophile, Charles tried to force the people of Madrid to adopt French dress styles in 1766, causing riots from which he fled to Aranjuez, leaving the government in the hands of his prime minister, Pedro Pablo Abarca y Bolea, conde de Aranda. The expulsion of the Jesuits from Spain (1767) is attributed to Aranda. An enlightened despot, Charles instituted important financial and economic reforms and curbed the power of the Inquisition.

CHARLES IV, king of Spain: b. Naples, Italy, Nov. 12, 1748; d. Rome, Jan. 20, 1819. He was brought to Madrid in 1759, when his father, then king of the Two Sicilies, became king of Spain as Charles III. In 1765 he married Maria Louisa of Parma, and in 1788, on the death of his father, succeeded to the throne. Weak and vacillating, he was dominated by his wife and his ministers. Spain was unable to withstand French pressure, and in 1796 was drawn into war against Great Britain. Louisiana was sold to France in 1800, and two years later Trinidad was ceded to Britain. In 1805, Spain was again induced to join France against Britain, and later that year suffered a disastrous defeat at Trafalgar. The Francophile policy of the prime minister, Manuel de Godoy, who exercised great influence over the king and his wife, brought on a revolution in 1808, which enabled Napoleon to dethrone the Bourbons. The king abdicated at Aranjuez on March 19, in favor of his son, Ferdinand VII, who in turn was forced to abdicate by Napoleon on May 6. See **BAYONNE CONFERENCE** (1808). Charles, who had repudiated his own abdication, was also forced to cede his right to the throne, and a month later, on June 6, Napoleon's brother,

Joseph Bonaparte, became king of Spain. Retiring to Compiègne, where he enjoyed a pension from Napoleon, Charles subsequently moved to Rome, where he spent his last years.

CHARLES I, king of Navarre. See **CHARLES IV**, king of France.

CHARLES II (called **CHARLES THE BAD**; **Fr. CHARLES LE MAUVAIS**), king of Navarre: b. 1332; d. Jan. 1, 1387. He succeeded his father, Philip, as count of Évreux, in 1343, and his mother, Queen Joanna, on the throne of Navarre in 1349. Three years later he married Jeanne, daughter of John II of France, and held a complicated but strong claim to the French throne by both inheritance and marriage. A man of ability, he was completely unscrupulous and earned his epithet "the Bad" by his thoroughly cruel behavior. He disputed King John's claim to parts of Normandy and Angoulême, and in 1356-1357 was imprisoned by the king. In 1358 he became captain general of Paris, and for two years he contended with the dauphin (later Charles V), who was serving as regent of France during John's captivity in England. He was defeated by the French in 1364, but subsequently renewed the struggle, and he also made trouble in Spain.

CHARLES III (called **CHARLES THE NOBLE**), king of Navarre: b. 1361; d. Olite, Spain, Sept. 7, 1425. The eldest son of Charles II of Navarre, he married Leonora, daughter of Henry II of Castile, in 1375, and succeeded to his father's kingdom in 1387, later being made duke of Nemours. He restored Cherbourg to France, and attempted to pacify the rival French factions. His reign was marked by considerable progress. He built canals and deepened rivers in Navarre, and made many other improvements. His two sons having predeceased him, he willed his kingdom to his daughter Blanche, wife of John II of Aragon, and mother of Charles, prince of Viana.

CHARLES (sometimes known as **CHARLES IV**, king of Navarre, prince of Viana: b. April 19, 1421; d. Barcelona, Spain, Sept. 25, 1461. He was the son of Blanche, heiress of Charles III of Navarre, and of King John II of Aragon. Although Navarre was bequeathed to Charles, and his right to succeed recognized by the Cortes, John seized the government in 1441 and banished his son. The king's second marriage, to Juana Henríquez, produced another son, later Ferdinand II of Aragon, and the new queen attempted to oust her stepson completely. As a result, civil war broke out, and in 1452 Charles was defeated and imprisoned. On his release, he promised not to take title to Navarre until his father's death, and went into exile in Italy. Eventually becoming reconciled with his father, he returned to Navarre in 1459, but was once more imprisoned. A new insurrection began, and John was forced to yield. He released his son and recognized his succession, but Charles died soon thereafter, perhaps poisoned by his stepmother. A cultivated man, he was the author of poems and chronicles, among them a history of the kings of Navarre.

CHARLES VII, king of Sweden: d. Visingö, Lake Vättern, Sweden, 1167. The son of King Sverker, he came to the throne in 1161 with the title of king of Swedes and Goths. Although he is styled the seventh Swedish king of his

name, he was the first historical King Charles, his six supposed predecessors being of doubtful authenticity. He fought against the Russians in 1164, and three years later was assassinated by Knut Eriksson, son of Eric IX.

CHARLES VIII (known as **KARL KNUTSSON**), king of Sweden and Norway: b. ?1408; d. Stockholm, Sweden, May 15, 1470. He took part in the revolt against the Danes led by Engelbrekt Engelbrektsson in 1434, and after the latter's death became the leader of the Swedish nationalists. Elected regent of Sweden by the nobles in 1436, he served until 1440, when the union with Denmark was re-established. He was king of Sweden from 1448 to 1457, from 1464 to 1465, and from 1467 to 1470, and king of Norway from 1449 to 1450. During years of alternating kingship and exile he fought a war with Denmark (1463-1470).

CHARLES IX, king of Sweden: b. Stockholm, Sweden, Oct. 4, 1550; d. Nyköping, Oct. 30, 1611. The third son of Gustaf Vasa, he became duke of Södermanland on his father's death in 1560. He participated in the revolt which brought about the deposition of his eldest brother, Eric XIV, in 1568, and he opposed the policies of his second brother, John III. When John died in 1592, Charles became regent for his brother's son, King Sigismund (Sigismund III of Poland), serving until 1594, when his nephew came from Poland to be crowned. A staunch Protestant, Charles opposed efforts to re-establish the Roman Catholic Church in Sweden. In 1598 he defeated Sigismund at Stångebro, Linköping, and in the following year was made hereditary prince of Sweden. He assumed the title of king in 1604 and ruled until his death. During his reign trade and mining were fostered, and the power of the nobles was curbed.

CHARLES X, king of Sweden. See **CHARLES X GUSTAVUS**.

CHARLES XI, king of Sweden: b. Stockholm, Sweden, Nov. 24, 1655; d. there, April 5, 1697. The son of Charles X Gustavus, he succeeded his father on the throne in 1660, and until 1672 the country was governed by a corrupt regency. As an ally of France in the Second Dutch War, Charles was defeated in several battles in 1675 and 1676 and lost some territory, but it was all recovered under the terms of the Peace of Nijmegen (1678-1679). During the regency the power of the nobles had been greatly increased, and in 1680 the king initiated a program of confiscation of large estates called the Great Reduction. Within two years he was almost an absolute monarch, but in general he used his power wisely. He founded the University of Lund, reorganized the army and navy, and strengthened public finance.

her. Accordingly, in 1699, Frederick IV of Denmark, Augustus II of Poland, and Peter I of Russia concluded an alliance which resulted in the Great Northern War (1700-1721). Danish troops invaded the territory of Frederick IV, duke of Holstein-Gottorp, Charles' brother-in-law. Swiftly retaliating, Charles invaded Denmark and forced the Danes to make peace at Travendal (1700). The attacks of Augustus and Peter remained to be repelled. The former was besieging Riga, while the latter menaced Narva and the country around the Gulf of Finland. Without returning to his capital (which in fact he never revisited), Charles had 20,000 men transported to Livonia and went to meet the Russians, whom he found over 40,000 strong in a fortified camp under the walls of Narva. On Nov. 20, 1700, a force of 8,000 Swedes placed themselves in battle order, under the fire of the Russians, and the engagement began. In less than a quarter of an hour the Russian camp was taken by storm. Most of the Russians were killed or drowned in the Narova (Narva) River, and the rest were taken prisoner or dispersed. Charles then crossed the Dvina River and drove the Saxon troops of Augustus from the eastern Baltic States. In 1702, the Swedes gained a brilliant victory at Kliszów and took Warsaw. Two years later, Charles dethroned Augustus and made Stanislas I Leszczyński king of Poland in his stead, and in 1706 he dictated the conditions of peace at Altranstädt.

Charles then set out to conquer the Russians. In August 1707, he left Saxony with 44,000 Swedes, while 6,000 remained behind to protect Stanislas. Although Charles moved at first toward Moscow, he changed his plan when he reached Smolensk, at the suggestion of the Cossack hetman, Ivan Stepanovich Mazepa, and proceeded to the Ukraine, where he hoped that the Cossacks would join him. Peter laid waste the Cossack country, however, and Mazepa could not procure the promised aid. Difficult marches, lack of provisions, perpetual attacks by the enemy, and severe cold weakened Charles' army. Then, as the king was about to invest the well-stocked city of Poltava, Peter appeared with 50,000 men. In reconnoitering, Charles was seriously wounded in the thigh, and in the decisive battle, which took place on June 28, 1709, he was obliged to issue his commands from a litter without being able to encourage his soldiers by his presence. The Swedes yielded to superior force, and the enemy gained a complete victory. Charles himself, together with Mazepa, fled with a small guard and finally found refuge in Turkish territory, at Bendery, Moldavia.

While the regency which was acting in Stockholm in the king's absence took measures for the defense of Swedish territory, Charles negotiated with Sultan Ahmed III and, in 1711, induced the Turks to declare war on Russia. The armies met on the banks of the Prut River in July. After the Turkish forces had surrounded the Russians, Peter was able to procure a peace (Treaty of the Pruth) in which Charles' interests were entirely neglected. The king made new plans and endeavored to induce the Turks to reopen hostilities, but Russian agents at the Porte were active against him, claiming that Charles wished to make himself, through Stanislas, master of Poland in order to attack the Turks. The Porte ordered the seraskier of Bendery to compel Charles to leave Turkish territory. If he refused, he was

fall
 throne and was declared of age by the Estates.
 Sweden's neighbors had become alarmed at her
 growing power, and the youth of the new king
 made this seem a favorable time to move against

¹ All dates in this article are Old Style.

to be brought to Adrianople (now Edirne). Unaccustomed to obeying others and apprehensive of being surrendered to his enemies, Charles determined to defy the Porte with the few hundred men remaining with him. When, on Feb. 1, 1713, his residence near Bendery was attacked by the Turks, he put up a dogged resistance. The house caught fire and he was about to abandon it when, his spurs becoming entangled, he fell and was taken prisoner. The Turks removed him from Bendery to Dimotika, where he remained for over a year. Then, escaping in disguise, he made an 80-day journey through hostile territory, reaching Stralsund, Prussia, then in Swedish hands, on Nov. 11, 1714. A combined army of Danes, Saxons, Prussians, and Russians invested the city, but although Charles defended it bravely, he was obliged to surrender the fortress on Dec. 13, 1715.

Proceeding to Lund, Charles took measures to defend the Swedish coast. Then, to recover his fortunes, he raised a new army of 20,000 men and decided, in 1717, to attack Norway. Part of the country had been conquered, and he was besieging Fredrikshald (now Halden) when, while inspecting the trenches before the fortress, he was killed by a bullet.

With Charles' death, Sweden ceased to be an imperial power. During his reign all the Swedish possessions except Finland were lost. The Great Northern War had passed through three stages: a war of defense; then a war of aggressions; and, finally, a struggle for national existence. Although Charles' ambitions had cost his country many lives and much territory, his people remained loyal to him and revered his memory.

Consult Godley, E. C., *Charles XII of Sweden* (London 1928).

CHARLES XIII, king of Sweden and Norway: b. Stockholm, Sweden, Oct. 7, 1748; d. there, Feb. 5, 1818. The second son of King Adolphus Frederick, he was trained as a naval officer. On his father's death, in 1771, he was recalled to Sweden from a tour of Europe, and in the following year played an important part in the bloodless revolution by which his brother, King Gustaf III, obtained control of the government. The king then appointed him governor general of Stockholm and duke of Södermanland. During the war with Russia of 1788–1790, Charles commanded the fleet and defeated the Russians in the Gulf of Finland. He was then appointed governor general of Finland. In 1792, following the assassination of Gustaf III, he became head of the regency which governed during the minority of Gustaf's young son, Gustaf IV. While uniting with Denmark to protect navigation, he was able to keep Sweden at peace and in 1796 relinquished control to his nephew, who had come of age. Gustaf IV was a weak king, whose decisions on foreign policy finally resulted in the Russian conquest of Finland. Accordingly, in 1809, he was deposed by a revolution and Charles was made regent and, on June 20, king of Sweden. The new monarch came to the throne at a very critical time. Although the Peace of Fredrikshamn (Sept. 17, 1809) gave Finland to Russia, it afforded Sweden the tranquillity necessary for repairing the country's heavy losses. Charles signed a new constitution, which restored a limited monarchy, and applied himself to the problem of succession to the throne. Childless, he had adopted as his heir Charles August (known also

as Christian), prince of Schleswig-Holstein-Sonderborg-Augustenburg, but the latter died in 1810. In August of that year, Marshal Jean Baptiste Bernadotte was elected by the Estates to replace him. Charles' prudent conduct during the war between France and Russia in 1812–1813 procured for Sweden, by the Treaty of Kiel of 1814, indemnification for the loss of Finland by the acquisition of Norway.

CHARLES XIV, king of Sweden and Norway. See **CHARLES XIV JOHN**.

CHARLES XV, king of Sweden and Norway: b. Stockholm, May 3, 1826; d. Malmö, Sept. 18, 1872. The son of King Oscar I, he succeeded his father on the throne in 1859. A liberal and popular ruler, he made important reforms in communal, ecclesiastical, and criminal law. In 1866 the Riksdag was reconstituted and made a two-chamber body, replacing the old Estates. Charles was an artist and a writer, his published works including *Fosterbröderne* (1848); *Hcidi, Gyllesdotter* (1852); *En Vikingsaga* (1855); and *Dikter*, a two-volume collection of poems (1863–1865).

CHARLES, Elizabeth (nee RUNDLE), English writer: b. Tavistock, England, Jan. 2, 1828; d. London, March 28, 1896. She married Andrew Paton Charles in 1851. Her books, based on semireligious themes, became very popular in England and the United States, the most famous of them being *The Chronicles of the Schönberg-Cotta Family* (1862), about Martin Luther. Among her other works are *The Martyrs of Spain and Liberators of Holland* (1862); *Diary of Mrs. Kitty Trevelyan* (1865); *Winifred Bertram and the World She Lived in* (1866); *The Draytons and Davenants* (1867); *Against the Stream* (1873); *The Bertram Family* (1876); and *Lapsed but Not Lost* (1877).

CHARLES, Jacques Alexandre César, French physicist, chemist, and inventor: b. Beaugency, France, Nov. 12, 1746; d. Paris, April 7, 1823. He taught physics at the Sorbonne and at the Conservatoire des Arts et Métiers, popularizing Benjamin Franklin's discoveries in electricity. In 1783 he made the first balloon using hydrogen gas, and himself made several ascents, including one to a height of 7,000 feet. Among his other inventions were a thermometric hydrometer and a number of optical instruments. He also anticipated the law of volumes named for Joseph-Louis Gay-Lussac (q.v.), and hence sometimes known as Charles's law. In 1785 he was elected to the Académie des Sciences.

CHARLES, Thomas, Welsh preacher: b. Llanfihangel Abercowin, Carmarthenshire, Wales, Oct. 14, 1755; d. Oct. 5, 1814. He was educated at Llanddowror and at Jesus College, Oxford, where he prepared for the Anglican ministry and received his B.A. degree in 1779. Ordained a deacon in 1778, he became a priest of the Church of England in 1780, and held several curacies. He soon became interested in Calvinistic Methodism, and because of his active work on its behalf was eventually denied employment by the Church of England. In 1784 he became a Methodist preacher and began a series of preaching journeys in Wales. Interested in the welfare of Welsh children, he established, in 1785, the sys-

tem of Welsh circulating schools, in which poor children were given instruction. Later, in 1789, he adopted the Sunday school system for those who worked during the week. He did much to kindle the great revivalist movement in Wales, establishing a press and organizing a movement for the wider distribution of Welsh Bibles, and in 1804 he helped to found the British and Foreign Bible Society. He issued a Biblical dictionary in four volumes (1805-1808) and some Welsh catechisms. Charles was in part responsible for the introduction of the circulating school system in Ireland and for the establishment of charity schools in Scotland, and the Gaelic School Society (1811). In 1810-1811 he organized the Welsh Calvinistic Methodists.

CHARLES, river, Massachusetts, flowing into Boston Bay between Boston proper and the former city of Charlestown. About 60 miles long, it rises in the southwestern part of Norfolk County and follows a winding course, first north, then east, northwest, and east again. The river is navigable to Watertown, 7 miles west of Boston.

CHARLES, Cape, cape, Virginia, situated opposite Cape Henry at the mouth of Chesapeake Bay, and forming the southern extremity of Northampton County, at latitude 37°7'N. and longitude 75°57'W. Near its tip is the town of Cape Charles, incorporated in 1886, and having a population (1950) of 2,427. Northeast of the cape, on Smith Island, is a lighthouse.

CHARLES ALBERT (Ital. CARLO ALBERTO), king of Sardinia: b. Turin, Italy, Oct. 2, 1798, d. Oporto, Portugal, July 28, 1849. The son of Charles Emmanuel, 6th prince of Savoy-Carignan (d. 1800), he was educated in France and Switzerland. For a short time after the abdication of Victor Emmanuel I in 1821, he served as regent of the kingdom, but was then exiled by the new king, Charles Felix, his distant cousin, and did not return to Piedmont until 1823. As the nearest heir, he succeeded to the throne on the death of Charles Felix in 1831. In the first years of his reign he promoted a number of beneficial reforms, but later became more absolute in his views. After the French Revolution of 1848, however, he granted a constitution which later became the basis for the Constitution of Italy, and he took the field against Austria on behalf of the revolted peoples of Lombardy and Venetia and the duchies of central Italy. The Austrians were defeated in several early encounters, but on July 23-25, 1848, Marshal Joseph Wenzel Radetzky won an overwhelming victory at Custoza, and Charles Albert was obliged to sue for an armistice. On its expiration he resumed hostilities, but the Battle of Novara, fought on March 23, 1849, proved fatal to his aspirations. On the same day he abdicated in favor of his son, Victor Emmanuel II, later king of Italy, and retired to Portugal.

CHARLES ALEXANDER. See **CHARLES**, prince of Lorraine.

CHARLES (I) ALEXANDER. See **CHARLES**, the name of two dukes of Württemberg.

CHARLES ANTHONY (Ger. KARL ANTON), prince of Hohenzollern-Sigmaringen: b.

Sept. 7, 1811; d. Sigmaringen, Germany, June 2, 1885. In 1849 he ceded his principality to King Frederick William IV of Prussia. As a general in the Prussian Army, he participated in a dispute over the reorganization of the army, from 1853 to 1862, and served (1863-1871) as military governor of the Rhineland region of Westphalia. The controversy over the candidature of his son Leopold for the crown of Spain in 1870 was the precipitating cause of the Franco-Prussian War.

CHARLES AUGUSTUS (Ger. KARL AUGUST), grand duke of Saxe-Weimar: b. Weimar, Germany, Sept. 3, 1757; d. Graditz, near Torgau, June 14, 1828. The son of Duke Ernest Augustus Constantine, he succeeded his father in 1758, his mother, Amalia, serving as regent for him until 1775. He served in the Prussian Army from 1786 until the Battle of Jena (1806), and then fought with the French until 1812. For his services as a member of the allied coalition against Napoleon (1813-1815), his duchy was made a grand duchy at the Congress of Vienna. Charles Augustus liberally patronized science and art, and under him his capital of Weimar became the literary center of Germany. He was a close friend of Johann Wolfgang von Goethe.

CHARLES CITY, city, Iowa, seat of Floyd County, situated at an altitude of 1,015 feet, on the Cedar River, 30 miles east-southeast of Mason City. It is served by the Illinois Central (freight only), the Chicago, Milwaukee, St. Paul and Pacific, and the Charles City Western railroads, and has an airport. The city serves as a trading center for the surrounding farming region, and has plant nurseries and establishments producing tractors, pharmaceuticals, and wood products.

The first permanent settlement was made in 1850 on a site originally known as The Ford. On incorporation, in 1869, the name of Charles City was adopted in honor of Charles Kelly, son of Joseph Kelly, the first settler. Government is by council and city manager; water supply system is municipally owned. Pop. (1950) 10,309.

CHARLES DE VALOIS, count of Valois, Anjou, and Maine: b. March 12, 1270; d. Nogent-le-Roi, France, Dec. 16, 1325. In 1285 he inherited from his father, King Philip III of France, the lordships of Crépy, La Ferté-Milon, Pierrefonds, and Béthisy, forming the countship of Valois. Five years later, by his marriage to Margaret, daughter of Charles II of Naples, he also became count of Anjou and of Maine. Charles aided Philip IV of France against England and in Flanders, and assisted his father-in-law in the latter's war with Aragon. Having married, as his second wife, Catherine of Courtenay, granddaughter of Baldwin II, Latin emperor of Constantinople, Charles claimed the throne of Constantinople, but was dissuaded from this ambition by Pope Boniface VIII. He was equally unsuccessful in his candidature for the imperial throne, Henry of Luxembourg being chosen emperor, as Henry VII, in 1308. During the reign of Louis X of France (1314-1316), Charles was a leader of the reactionary feudal group. His eldest son became king of France as Philip VI, thus founding the French royal house of Valois.

CHARLES D'ORLEANS. See **ORLÉANS**, **CHARLES**, DUKE OF.

CHARLES EDWARD. See **STUART, CHARLES EDWARD LOUIS PHILIP CASIMIR.**

CHARLES EMMANUEL I (Ital. **CARLO EMANUELE**), duke of Savoy: b. Rivoli, Italy, Jan. 12, 1562; d. Savigliano, July 26, 1630. On the death of his father, Emmanuel Philibert, in 1580, he succeeded to the duchy. Five years later he married Catherine, daughter of Philip II of Spain. With the aid of his father-in-law, he formed the plan of adding Provence to his dominions, and in 1589 the Parlement of Aix acknowledged him as protector of the province. By 1601, however, the French had forced him to relinquish all territory beyond the Rhone River. Charles Emmanuel was no more successful in his plans to conquer Cyprus and Macedonia, and in 1602 the Swiss repulsed an unprovoked Savoyard attack on Geneva. At various times the duke was at war with France, Spain, and Tuscany, but in 1618 he was obliged to make peace with all his enemies. Ten years later he joined Spain in a war against France. Unaided by his ally, he was able to defend his territory only with great difficulty, and he died when the struggle had almost exhausted his army's strength.

CHARLES EMMANUEL II, duke of Savoy: b. June 20, 1634; d. June 12, 1675. On the death of his father, Victor Amadeus I, in 1638, he succeeded to the duchy, his mother, Christina, sister of Louis XIII of France, serving as regent until her death in 1663. During the regency two of the young king's uncles fomented rebellions against him, but there was less dissension after he assumed control of the government. His reign saw considerable artistic development.

CHARLES EMMANUEL III, duke of Savoy and, as **CHARLES EMMANUEL I**, king of Sardinia: b. Turin, Italy, April 27, 1701; d. there, Feb. 20, 1773. The son of Victor Amadeus II of Savoy (Victor Amadeus I of Sardinia), he succeeded his father as duke of Savoy and king of Sardinia on the latter's abdication in 1730. As an ally of France and Spain, he joined in the War of the Polish Succession, but gained no advantage from the Treaty of Vienna (1735). In the War of the Austrian Succession he was an ally of Austria, and by the Treaty of Aix-la-Chapelle (1748) acquired part of the Duchy of Milan. During his reign Piedmont enjoyed much prosperity.

CHARLES EMMANUEL IV, duke of Savoy and, as **CHARLES EMMANUEL II**, king of Sardinia: b. Turin, Italy, May 24, 1751; d. Rome, Oct. 6, 1819. In 1796, on the death of his father, Victor Amadeus III of Savoy (Victor Amadeus II of Sardinia), he became duke of Savoy and king of Sardinia. Two years later, however, the French seized Savoy and Piedmont, and he retained only Sardinia. He abdicated in favor of his brother, Victor Emmanuel I, in 1802. Four years before his death he became a Jesuit.

CHARLES (II) EUGENE. See **CHARLES**, the name of two dukes of Württemberg.

CHARLES FELIX (Ital. **CARLO FELICE**), king of Sardinia: b. Turin, Italy, April 6, 1765; d. April 27, 1831. The son of Victor Amadeus III, duke of Savoy (Victor Amadeus II of Sardinia), he served as viceroy of Sardinia from

1799 to 1806, and from 1817 to 1821. In that year, following the abdication of his brother, Victor Emmanuel I, he succeeded to the throne of Sardinia while absent from Turin. Returning to the city, he exiled his distant cousin, Charles Albert, who had been serving as regent and had granted a constitution, and defeated the constitutional forces. The last ruler of the main line of the house of Savoy, he was succeeded by Charles Albert, of the branch of Savoy-Carignan.

CHARLES FRANCIS JOSEPH. See **CHARLES I**, emperor of Austria.

CHARLES X GUSTAVUS, king of Sweden: b. Nyköping, Sweden, Nov. 8, 1622; d. Göteborg, Feb. 13, 1660. The grandson of King Charles IX and the nephew of Gustavus Adolphus, he received part of his excellent education from Count Axel Gustafsson Oxenstierna, regent during the minority of Queen Christina, and spent the years 1638–1640 in Germany, the Netherlands, and France. When Christina abdicated, in 1654, he succeeded to the throne and in the following year declared war on Poland. Invading the country in 1656, his troops won the Battle of Warsaw, but Denmark, the empire, and Russia declared war on Sweden, and he was forced out of Poland in 1657. He successfully invaded Denmark (1658), however, and in 1660, shortly after the king's death, Denmark ceded to Sweden the remaining provinces she held in the southern and southwestern part of the Swedish mainland, thus restoring to Sweden her natural frontiers. In addition, Livonia was ceded to Sweden by Poland.

CHARLES XIV JOHN (original name: **JEAN BAPTISTE JULES BERNADOTTE**), king of Sweden and Norway: b. Pau, France, Jan. 26, 1763; d. Stockholm, Sweden, March 8, 1844. The son of Henri Bernadotte (1711–1780), a lawyer of Pau, he enlisted in a French regiment of marines in 1780. Although he was only a sergeant by 1789, he rose rapidly thereafter, becoming a colonel in 1792 and a general of division two years later. He served with distinction in the campaigns on the Rhine, and in 1797 first met Napoleon Bonaparte, who formed a high opinion of Bernadotte's abilities. In the following year he married Desirée Clary (1777–1860), sister-in-law of Joseph Bonaparte, and he served briefly as minister of war in 1798. On the establishment of the empire in 1804, Bernadotte was created marshal of France, and, after the Battle of Austerlitz, prince of Pontecorvo. In the Battle of Wagram (1809), he led the Saxon contingent. At this time, Gustaf IV had been deposed as king of Sweden. He was succeeded by his uncle, Charles XIII, who, having no children, had adopted as his successor Charles August (known also as Christian), prince of Schleswig-Holstein-Sønderborg-Augustenburg. The latter died in 1810, however, and in August of that year succession to the Swedish crown was offered to Marshal Bernadotte. After obtaining the consent of Napoleon, he accepted, and in October he arrived in Sweden, where, having previously adopted the Lutheran faith, he was proclaimed heir apparent to the throne under the title of Prince Charles John. He had not long been established in this dignity before serious disagreements arose between him and Napoleon, whose blockade of the Continental ports was detrimental to Swedish commercial interests.

The final result was a complete rupture of relations, and in 1813 Sweden joined the allied coalition against Napoleon. At the Battle of Leipzig (1813), Charles John contributed effectively to the allied victory. The acquisition of Norway was one of his chief aims; it was provisionally ceded by Denmark under the Treaty of Kiel (1814), but a military campaign was required to make the cession effective. In 1818, following the death of Charles XIII, Charles John became king of Sweden and Norway. During his reign agriculture and commerce made substantial advances, and many important public works were completed. Although the king could not speak Swedish and was criticized for his ultraconservatism, he was generally popular with his subjects.

Consult Barton, D. P., *The Amazing Career of Bernadotte, 1763-1844* (Boston 1929); Scott, F. D., *Bernadotte and the Fall of Napoleon* (Cambridge, Mass., 1935).

CHARLES LEOPOLD. See CHARLES V, duke of Lorraine.

CHARLES LOUIS (Ger. KARL LUDWIG), DUKE OF TESCHEN, archduke of Austria: b. Florence, Italy, Sept. 5, 1771; d. Vienna, Austria, April 30, 1847. The third son of Emperor Leopold II, he spent his youth in Tuscany (of which his father was then grand duke), Vienna, and the Austrian Netherlands. Adopting a military career, he distinguished himself at the Battle of Jemappes (1792), and two years later was made a major general. He commanded the advance guard of Friedrich Josias, prince of Saxe-Coburg, at Neerwinden in 1793 and was then appointed governor general of the Austrian Netherlands. In 1796 he became field marshal of the empire and commander of the Austrian forces on the Rhine. After turning his retreat at Wetzlar into a victory over Gen. (later Comte) Jean Baptiste Jourdan, he obtained victories at Amberg and Würzburg, compelling Gen. Jean Victor Moreau to retreat. In the winter of 1797, Charles Louis captured Kehl, the only position the French occupied in Germany, and was appointed governor and captain general of Bohemia. After the fruitless Congress of Rastatt, he became head of the forces on the Rhine and, in 1799, defeated Jourdan at Stockach. Misunderstandings between him and the Russian general, Count Aleksandr Vasilievich Suvorov, and poor health then forced him to resign his command and retire to Bohemia. In 1809, Charles Louis won a victory over Napoleon at Aspern, but he was defeated at Wagram and retired from the army. He was the author of several excellent books on the theory and art of war.

CHARLES LOUIS (Ger. KARL LUDWIG), archduke of Austria: b. Vienna, Austria, July 30, 1833; d. there, May 19, 1896. The younger brother of Emperor Francis Joseph of Austria and of Emperor Maximilian of Mexico, he served as governor of the Tirol from 1855 to 1861. He was the father of Archduke Francis Ferdinand, whose assassination at Sarajevo in 1914 was the immediate cause of World War I.

CHARLES MARTEL (Ger. KARL MARTELL), Frankish ruler of Austrasia: b. ?689; d. Quierzy, France, Oct. 22, 741. The natural son of Pepin of Herstal, mayor of the palace under the last Merovingian kings, he was imprisoned

after the death of his father (714), but escaped and by 715 was recognized as ruler of Austrasia. By 717 he had conquered the Neustrians and made himself mayor of the palace. Through his unification of the Franks he saved France from conquest by the Arabs, who had crossed the Pyrenees in 719. Near Poitiers, on Oct. 25, 732, he won a decisive victory over the forces of Abd-er-Rahman, Arab emir of Spain. He also extended his influence over the various tribes of western Germany and, in 735, over Burgundy. Charles Martel was a man of foresight and ability, resembling in many respects his celebrated grandson, Charlemagne.

CHARLES OF ANJOU. See CHARLES I; CHARLES II; CHARLES III, kings of Naples.

CHARLES OF BAVARIA. See CHARLES VII, Holy Roman emperor.

CHARLES OF DURAZZO. See CHARLES III, king of Naples.

CHARLES OF LUXEBURG. See CHARLES IV, Holy Roman emperor.

CHARLES OF ORLEANS. See ORLÉANS, CHARLES, DUKE OF.

CHARLES OF VALOIS. See CHARLES DE VALOIS.

CHARLES ROBERT OF ANJOU. See CHARLES I, king of Hungary.

CHARLES THE BAD. See CHARLES II, king of Navarre.

CHARLES THE BALD. See CHARLES II, Holy Roman emperor.

CHARLES THE BOLD. See CHARLES, duke of Burgundy.

CHARLES THE BOLD. See CHARLES II, duke of Lorraine.

CHARLES THE FAIR. See CHARLES IV, king of France.

CHARLES THE FAT. See CHARLES III, Holy Roman emperor.

CHARLES THE GOOD. See CHARLES, count of Flanders.

CHARLES THE GREAT. See CHARLEMAGNE.

CHARLES THE GREAT. See CHARLES III, duke of Lorraine.

CHARLES THE NOBLE. See CHARLES III, king of Navarre.

CHARLES THE SIMPLE. See CHARLES III, king of France.

CHARLES THE WELL-BELOVED. See CHARLES VI, king of France.

CHARLES THE WISE. See CHARLES V, king of France.

CHARLES TOWN, town, West Virginia, seat of Jefferson County; altitude 530 feet; 8 miles southwest of Harper's Ferry; on the Baltimore and Ohio and the Norfolk and Western railroads. It is the center of an agricultural region with deposits of limestone and dolomite. Brassware, fertilizers, refrigeration and wood products are manufactured. Charles Town was named for Charles Washington (brother of George) who laid it out in 1786. It was first incorporated in 1787. Here John Brown, after his raid at Harper's Ferry, was tried and hanged in 1859. On Oct. 18, 1863, a Confederate cavalry division, under Gen. John Daniel Imboden (1823-1895), captured the place and took prisoners and large quantities of military stores but, on the approach of a superior Union force, immediately withdrew. Pop. (1940) 2,926; (1950) 3,030.

CHARLESTON, city, Illinois, and seat of Coles County; altitude 686 feet; on the New York Central, and the Nickel Plate (New York, Chicago and St. Louis) railroads; 135 miles northeast of St. Louis; with an airport. The city is situated in an agricultural and dairy farming area. The principal industries include railroad shops, flour mills, metal manufactures, and shoe, broom, woolen, and cheese factories. Charleston is the site of the Eastern Illinois State College established in 1899. In and near the city are many mementos of Abraham Lincoln and his parents, including the original log cabin, seven miles south of the city. One of the Lincoln-Douglas debates in 1858 was held here. Government is by mayor and council. Pop. (1930) 8,012; (1940) 8,197; (1950) 9,146.

CHARLESTON, city, Missouri, seat of Mississippi County, altitude 326 feet, 15 miles by road from Cairo, Ill. and on the Missouri Pacific Railroad. Big Oak State Park is nearby, and there are many Indian mounds in the vicinity, of archaeological interest. Charleston distributes cotton, grain, potatoes, fruit, livestock, and soy beans; has flour mills, cotton gins and compresses and woodworking shops; and manufactures shoes. The city is governed by council and manager. Pop. (1940) 5,182; (1950) 5,500.

CHARLESTON, city, South Carolina, is the largest city in the state, Charleston County seat, and an important Atlantic seaport, located on the southeast coast of South Carolina, practically midway between New York, N. Y. and Miami, Fla. With a land area of 4.49 square miles and an altitude ranging from sea level to 17 feet, the city is situated on a narrow peninsula between the Cooper and Ashley rivers, at the head of a broad, virtually landlocked bay formed by their confluence, $7\frac{1}{2}$ miles from the Atlantic Ocean. By automobile, Charleston is 414 miles southwest of Richmond, Va.; 109 miles northeast of Savannah, Ga.; and 114 miles southeast of Columbia, S. C. The city enjoys a rather mild, equable climate, with a mean average temperature of about 66°F.; the average annual rainfall of around 45 inches is distributed somewhat unevenly throughout the year.

Charleston is a city of unusual historic and scenic interest. The older, residential section stretches from Broad Street south to the lower end of the peninsula, where the Battery (White Point Gardens) commands a view of the harbor. To the north, on the neck of the peninsula, is

the industrial area with its phosphate plants and oil refineries. Along the Ashley River, Hampton Park occupies part of the site of the South Carolina Interstate and West Indian Exposition (1901-1902). Southeast, over the Cooper River Bridge, about 15 minutes from the city, are popular ocean beach resorts on the Isle of Palms and Sullivan's Island with several beautiful and gracious hotels; while to the southwest is Folly Beach, reached by way of the Ashley River Memorial Bridge. Within a radius of 30 miles of Charleston are a number of famous plantation gardens, which attract thousands of tourists each spring. Particularly noteworthy are Magnolia, Runnymede, Middleton Place and Mateeba Gardens on the Ashley River; Cypress Gardens on the Cooper River; and the Oaks on Goose Creek.

The entrance to Charleston's excellent harbor has been improved by the construction of two converging stone jetties, and by increasing the depth of the channel to 35 feet. Flanking the entrance to the harbor are historic Fort Moultrie on Sullivan's Island and Fort Johnson on James Island, while Fort Sumter and Castle Pinckney are situated on small islands in the bay. Becoming the official state port in 1924, Charleston has a nine-mile waterfront, principally on the Cooper River, where numerous docking and warehouse facilities are provided. About five miles north, also on the west bank of the Cooper, is the only first-class United States Naval Base on the Atlantic coast south of Norfolk, Va.; two and a half miles beyond are the port terminals, formerly an army supply base.

Transportation.—On several modern highways and inland waterways, Charleston is served by the Eastern, National, and Delta airlines, by the Atlantic Coast Line, Seaboard Air Line, and Southern railroads; by motor bus and truck lines, and by various steamship lines operating on the coastwise, intracoastal, and overseas routes. The city has a well-equipped municipal airport and yacht basin.

Commerce and Industry.—Charleston has considerable manufacturing and shipping, an extensive wholesale and retail trade, and an important tourist business. Leading products of its trade include lumber, truck garden produce, and sea foods; while its principal manufactures comprise fertilizer, wood products, asbestos, asphalt, paper, petroleum products, shipbuilding, turpentine, cigars, and textile products. The chief exports include lumber, petroleum products, cotton and cotton goods, and tobacco; imports consist principally of petroleum, raw materials for the manufacture of fertilizer, and sugar.

Government.—The mayor and council are each elected for a term of four years, half of the council being elected by wards, and half at large. The administrative officials and boards that head the various departments into which the municipal government is organized are partly appointive by the mayor and partly elective by the council. The city has made considerable progress in slum clearance and low-rent government housing. The United States government maintains at Charleston a federal district court, headquarters of the customs district of South Carolina, the 6th Naval District, the 6th Light-house District, and the South Atlantic Division of the Army Engineer Corps. Fort Moultrie is the headquarters of the harbor defense of Charleston.

Education.—Among the many educational

institutions in Charleston are the College of Charleston, founded in 1770, chartered in 1785, a municipal college since 1837, and one of the oldest free city colleges in the United States; the Medical College of South Carolina, established in 1823, and a state institution since 1913; the Citadel (Military College of South Carolina), founded in 1842, originally an arsenal; Porter Military Academy (1867), for boys; and Ashley Hall, a girl's school. The Charleston Library Society, a private enterprise organized in 1748, is the third oldest library in the United States; this society founded the Charleston Museum in 1773. In addition, there is the Charleston County Free Library, established in 1930.

Culture.—Charleston has enjoyed a distinguished cultural history, and many of the traditions of the old South still survive today. The first building in the United States designed wholly for theatrical purposes was the Dock Street Theater, which opened on Feb. 12, 1736, with Farquhar's *The Recruiting Officer*. Faithfully restored with WPA assistance, it was reopened in 1937 with a presentation of the same play. The Saint Cecilia Society, founded in 1766, was America's pioneer musical organization, and sponsored the nation's first symphony orchestra; later it became a purely social group. In the field of painting, such noted artists as Washington Allston, Samuel F. B. Morse, John James Audubon, Thomas Sully, John Blake White, and Charles Fraser lived in Charleston during the early 19th century. Shortly before the Civil War, Charleston was the center of an important literary group associated with *Russell's Magazine* (1857-1860), which included William Gilmore Simms, Henry Timrod, Paul Hamilton Hayne, William John Grayson, and Samuel Henry Dickson. After World War I, there was a literary revival in Charleston led by Dubose Heyward and Hervey Allen: together they founded the Poetry Society of South Carolina in 1920, and wrote *Carolina Chansons: Legends of the Low Country* (1922).

Buildings.—The older section of the city still retains much of its 18th century aspect, and legislation has been passed to preserve its unique character. Notable public buildings include the Old Powder Magazine (1713); County Court House (1792); City Hall (1801); Records (Fireproof) Building (1822), designed by Robert Mills, and believed to be the first fireproof construction in the United States; and Market Hall (1841), now a Confederate museum. Three of the city's most important churches are St. Michael's Episcopal Church (1752-1761); St. Philip's Episcopal Church (1835-1838), in whose cemetery are buried many distinguished South Carolinians; and the French Huguenot Church (1845). Domestic architecture is represented by excellent examples from the various early periods: the Georgian colonial style (Heyward-Washington House, 1740-1750; Robert Brewton House, c. 1730; Miles Brewton, or Pringle House, c. 1765; Col. John Stuart House, c. 1772); the postcolonial style of the early republican period (Joseph Manigault House, 1790 or later; Nathaniel Russell House, c. 1811); and the more grandiose neoclassicism of the antebellum period (Allston House, c. 1850). Characteristic of Charleston is the so-called single house, set with the narrow gable end toward the street, and the entire long side hung with open galleries, two or three tiers in height.

History.—In April 1670 three ships, carrying some 150 English and Irish colonists under the leadership of Governor William Sayle, landed on the west bank of the Ashley River to make the first permanent settlement in the Province of Carolina. Known as Albemarle Point until 1671, when it was renamed Charles Town in honor of King Charles II, this location proved poorly adapted for defense, and in 1672 a walled town was laid out about six miles distant at Oyster Point, the present site of Charleston, to which the colonists moved in 1680. The new settlement, which subsequently became known as Charles Town, soon developed a substantial Indian and maritime trade. Rice, first cultivated in 1685, was the province's staple crop until the second half of the 18th century, when the introduction of indigo further strengthened the planter class and the system of slave labor. In 1706, during Queen Anne's War, a French-Spanish fleet attempted unsuccessfully to take the town, and in 1718 a campaign to end piracy along the Carolina coast resulted in the capture of Stede Bonnet, Blackbeard, and Richard Worley. By 1775, Charleston had become the third most important seaport in the American colonies and the largest and most prosperous city south of Philadelphia. It was the first Southern city to join the revolutionary movement, Fort Johnson being seized on Sept. 15, 1775, and the royal governor forced to flee. The Provincial Congress of South Carolina adopted the first independent state constitution of the American colonies on March 26, 1776, Charles Town remaining the state capital until 1786, when Columbia was founded for that purpose. Charles Town was repeatedly attacked by the British and finally surrendered on May 12, 1780, after a two month's siege by land and sea. The British evacuated the city on Dec. 14, 1782.

Charleston was incorporated as a city under its present name on Aug. 13, 1783. The Non-intercourse and Embargo acts and the War of 1812 dealt a heavy blow to its commerce, but the introduction of cotton growing on a large scale after 1800 soon became a major factor in the city's continuing progress. With the completion of the South Carolina Railroad (from Charleston to Hamburg, S. C., on the Savannah River; 136 miles, then the longest passenger steam railroad in the world), considerable amounts of Up Country produce were diverted from the rival port of Savannah. Charleston was the scene of the passing of the Ordinance of Nullification (Nov. 24, 1832), and the first Ordinance of Secession (Dec. 20, 1860). The Civil War began with the bombardment and capture of Fort Sumter by Confederate troops on April 12/13, 1861. Into Charleston harbor came the first fleet of Federal ironclads (April 7, 1863) and the first submarine, the Confederate *Hunley*, to sink an enemy ship in time of war (Feb. 17, 1864). The city held out until Feb. 17, 1865, when after a siege lasting 567 days it was finally evacuated.

With the overthrow of carpetbag rule after 1876 by Governor Wade Hampton, Charleston gradually began to recover from the setback of the Reconstruction period, and since World War I its commerce and industry have greatly expanded. On Aug. 31, 1886, about 90 per cent of the city's buildings were damaged by a severe earthquake, which destroyed between \$5,000,000 and \$6,000,000 worth of property; the city was

struck by two tornados on Sept. 20, 1938, and by a hurricane on Aug. 12, 1940.

Population.—The first colonists were soon followed by English settlers from Barbados and Virginia, French Huguenots, New England dissenters, Dutch immigrants, and Quakers; Scotch-Irish Presbyterians, Swiss and South German Lutherans, French Catholics from Acadia, Welsh from Delaware, and Jews arrived in the 18th century; and North Germans and Irish in the 19th century. The first Negro slaves were brought in 1672, and Negroes now compose 46 per cent of the city's population. Population: (1685) c. 2,500; (1700) c. 5,000; (1775) 15,000; (1800) 18,824; (1850) 42,985; (1900) 55,807; (1940) 71,275; (1950) 68,243.

Bibliography.—Leiding, H., *Charleston, Historic and Romantic* (Philadelphia 1931); Wallace, David D., *History of South Carolina* (Chicago 1934); Bowes, F. P., *Culture of Early Charleston* (Chapel Hill 1942); Molloy, R., *Charleston, A Gracious Heritage* (New York 1947).

CHARLESTON, city, West Virginia, is the capital and the second largest city in the state, and the seat of Kanawha County. It is situated at an altitude of about 600 feet in the Kanawha Valley, on the navigable Kanawha River at its confluence with the Elk. The river flows through the heart of the city, dividing it into north and south sections which are connected by bridges. Charleston is partly hemmed in by the western foothills of the Allegheny Mountains. It is located 50 miles east of Huntington, 212 miles southeast of Cincinnati, and 387 miles southwest of Washington, D.C. The city is on a network of modern highways and is served by motorbus and truck lines in all directions, by river boats, and also by the Baltimore and Ohio, the New York Central, the Chesapeake and Ohio, and the Virginian railroads. A mile north of the city is the \$9,000,000 county-owned Kanawha Airport. This airport serves as a terminal for several major airlines, and is also the home base of a West Virginia National Air Guard squadron.

Charleston is not only the political center of the state but also its foremost industrial and commercial center. It is the hub of a district, rich in natural resources, which produces large quantities of bituminous coal, oil, natural gas, and brine. Manufactures in the city and its immediate vicinity include base chemicals, glass and glass products, axes, machinery, tools, mining equipment, and wood and clay products. Some of its factories are among the largest of their kind in the world. In the manufacture of chlorine, the local brines are used extensively. The city is also an important distributing center for the wholesale and retail trades.

Charleston is governed under the mayor-council plan. After 1936 the city spent large sums for public improvements, including a 5-lane river front boulevard, bridges, schools, and a city auditorium, which seats 3,600 persons. Its educational and cultural institutions embrace a modern public school system, parochial and commercial schools, Morris Harvey College, Mason College of Music and Fine Arts, the Kanawha County Public Library, the state libraries, the state museum, the Open Forum; the Civic Music Association, which sponsors each season concerts by noted artists; the Charleston Symphony Orchestra, and a Little Theater movement. The city has several parks, playgrounds, and recreation centers, and nearby are a number of points of scenic interest. Centered in Charleston are

most of the functions of the state government, and the United States government maintains a district court and other agencies there. Among the city's many attractive, modern buildings, the most outstanding is the state capitol, a U-shaped limestone and marble structure of Italian Renaissance design, which replaced the old capitol destroyed by fire in 1921. It was completed in 1932. Two additional buildings to house state departments were opened in 1951.

History.—In 1787 Col. George Clendenin, a member of the Virginia Assembly from Greenbrier County, was delegated by Governor Edmund Randolph to organize a company of rangers for the protection of the people residing in the Great Kanawha Valley, and in 1788 Colonel Clendenin erected a fort which he called Fort Lee after Governor Henry Lee of Virginia, on the site of the present city of Charleston. The completion of this fort marked the beginning of the city. Scotch-Irish and German settlers left the Shenandoah Valley to settle here. In 1789 Kanawha County was organized and Fort Lee became in effect the county seat. The Virginia Assembly authorized the establishment of a town on the site in 1794. At first the community was called Charles Town; later the name was shortened to Charleston. For about a century the growth of the town was very slow. In 1870, when its population was about 3,000, Charleston was incorporated as a city, and in the same year was made the state capital, but lost this distinction to Wheeling in 1875. However, in 1885 Charleston became the permanent capital. With large-scale industrial development of the Kanawha Valley since the turn of century, and especially since World War I, the city's progress has been rapid. Pop. (1900) 11,099; (1950) 72,878.

CHARLESTOWN, town, Indiana, in Clark County. It is 14 miles by highway northeast of Louisville, Ky. and is on the Baltimore and Ohio and the Pennsylvania railroads. The town is situated in a rich agricultural district producing tobacco, livestock and dairy products, as well as limestone from quarries. It is the site of the Indiana Ordnance Works and the Hoosier Ordnance Plant. Pop. (1950) 4,760.

CHARLESTOWN, former city, Massachusetts, since 1874 a part of the municipality of Boston. One of the chief navy yards in the United States, occupying an area of about 100 acres, is in the southeast part of Charlestown. It was settled as early as 1629, and in 1634 became a town, its original territory being considerably larger than at present, having been divided up to form the towns of Woburn, Malden, Stoneham, Burlington and Somerville, and parts of Medford, Cambridge, Arlington and Reading. The Battle of Bunker Hill (q.v.) was fought here June 17, 1775, at which time the British set fire to the town, destroying 320 buildings. It had a population of 25,655 at the time of its annexation to Boston.

Consult Frothingham, Richard, *History of Charlestown* (Boston 1845-1849); Sawyer, Timothy T., *Old Charlestown* (Boston 1902).

CHARLEVILLE, shâr'lê-vêl', commune, France, in the Department of the Ardennes, on the east bank of the Meuse, opposite Mézières, with which it is connected by a suspension bridge. It is regularly built, has straight, wide streets, and a wide public square. It manufactures hard-

ware, leather, sugar, brushes, and beer; and the Meuse affords facilities for considerable trade in metals, coal, iron, slate, wire, and nails. It was the medieval Arcae Remorum and Carolopolis, and an important military station until the fortifications were destroyed in 1687. Pop. (1946) 20,193.

CHARLEVOIX, shär'lë-vwà', **Pierre François Xavier de**, French Jesuit traveler: b. St. Quentin, Oct. 29, 1682; d. La Flèche, Feb. 1, 1761. He became a member of the Society of Jesus in 1698 and taught in Quebec from 1705 to 1709. After a brief return to France he was again sent to America in 1720 by the duke of Orléans. The object of this journey was the discovery of the "Western Sea" then supposed to be west of the Mississippi. He voyaged down the Mississippi to New Orleans. His chief title to fame rests on his *Histoire et description générale de la Nouvelle France* (1744; Eng. trans. by J. G. Shea, 1866-1872). His other works include *Histoire de l'établissement, des progrès et de la décadence du Christianisme dans l'empire du Japon* (1715); *Vie de la mère Marie de l'Incarnation* (1724); *Histoire de l'Isle Espagnole, ou de Saint-Dominique* (1730); and *Histoire du Paraguay* (1756).

CHARLEVOIX, shär'lë-voi, city, Michigan, summer resort, and Charlevoix County seat; altitude 592 feet; at the mouth of the Pine River, fronting on Lake Michigan, Lake Charlevoix, and Round Lake, 41 miles north-northeast of Traverse City, on the Pere Marquette Railroad. Corn, radish seed, and potatoes are the main crops. There are whitefish and trout fisheries, and a branch station of a United States fish hatchery is here. The early settlement, on the site of an Indian village, was known as Pine River. The city was chartered in 1905. Pop. (1950) 2,695.

CHARLOTTE, shär'löt', city, Michigan, and seat of Eaton County, altitude 907 feet, 18 miles southwest of Lansing, on Battle Creek River, and on the Michigan Central and Grand Trunk railroads, one federal and three state highways. It is in a dairying and bean-raising region. Livestock is auctioned here. The manufactured products are chairs, radios, road machinery, sauerkraut, ice cream and condensed milk, and canned vegetables. Charlotte was settled in 1835, incorporated in 1871 as a village, and as a city in 1891. It has a mayor and council. Pop. (1940) 5,544; (1950) 6,606.

CHARLOTTE, principal city, North Carolina, and seat of Mecklenburg County, altitude 732 feet, on the Southern, Seaboard Air Line, Norfolk Southern, and Piedmont and Northern railroads, 300 miles southwest of Richmond and 231 miles northeast of Atlanta, and in south central North Carolina, 20 miles from South Carolina border. It is the point of convergence of three federal highways and three state highways. There are one major municipal airport and three privately-owned airports. The city covers an area of 30 square miles in the approximate center of Mecklenburg County.

Charlotte is the retail marketing center for an area comprising 24 surrounding counties in both North and South Carolina. The population of these counties approaches 1,250,000. The 1948

census of business published by the Bureau of the Census listed the city's retail sales as \$168,818,000 and wholesale sales as \$962,651,000.

Educational institutions include 30 public schools, having a combined enrollment of 21,000; Queens College (Presbyterian, founded 1857) for women; Charlotte College (coeducational, junior college); Johnson C. Smith University (formerly Biddle University, founded 1867) for Negroes; Davidson College (Presbyterian, located 20 miles north in Davidson, N. C.) for men. The city also has a well-equipped public library, supported by city and county tax levies.

Charlotte is located in the center of the vast Southern textile industry which is the predominating industry of the region. There are over 400 manufacturing plants in Mecklenburg County; 53 manufacturing textile products; 89 in the food industry; 30 making wearing apparel; 54 publishers, printers and bookbinders; 33 chemical manufacturers; 36 machinery manufacturers; and other miscellaneous industries. In 1950, manufacturing employment in the county exceeded 18,500.

The city is also an important construction and banking center for the Carolinas. The headquarters of many of the largest construction firms of the South are located here and there is a branch of the Federal Reserve Bank.

Charlotte has a city manager government with a mayor and 7 councilmen. Modern zoning regulations are in force. The waterworks is owned and operated by the municipality.

History.—Charlotte was settled about 1750, was incorporated in 1768, and became the county seat in 1774. It received its city charter in 1866 and its second charter in 1907. President Andrew Jackson and President James K. Polk were born near Charlotte. The Mecklenburg Declaration of Independence, signed in the city in May, 1775, is commemorated by a monument at the County Court House. In September, 1780, Lord Cornwallis entered Charlotte, and occupied it for several days. He called it a "hornet's nest," and this has since been adopted as the city's emblem. Later in the year Gen. Horatio Gates made his headquarters here. The city on April 10, 1865 was the last meeting place (at the Phifer Home) of the full Confederate Cabinet. In the early 1800's gold was produced in Mecklenburg and Cabarrus counties, and in 1837 a branch United States mint was established at Charlotte. This branch mint was torn down in 1935 to make way for a new wing of the post office. However, a group of interested citizens obtained the materials and reconstructed the building on another site. It is now the Mint Museum of Art. Pop. (1920) 46,338; (1930) 82,675; (1940) 100,899; (1950) 134,042.

CHARLOTTE AMALIE, shär'löt ä-mäl'yë, formerly (1921-1937) St. Thomas, seaport and capital of the Virgin Islands (q.v.). Pop. (1940) 9,801; (1950) 11,463.

CHARLOTTENBURG, shär'löt'n-bürg, residential section of Berlin, Germany, now in the British Sector, five miles west of the center of Berlin, and served by the Stadtbahn, the Ringbahn, and the elevated and underground railways. Once a city of Brandenburg, Prussia, it was an important industrial center, noted especially for its porcelain factory, established in 1761. It still manufactures porcelain along with such items as

beer, glass, pottery, and dyes, although its chief significance is as a residential district.

It is an important educational and cultural part of Berlin, containing a technical academy with a valuable architectural museum, state schools of music and of plastic and graphic arts, a physical-technical institute, a zoological garden, and several museums. Buildings of interest include the Charlottenburg palace, originally a country house erected by Sophie Charlotte, wife of Frederick I, and its garden with the famous mausoleum, erected in 1810 by Friedrich von Gertz, containing the tombs of Frederick William III and his queen, Louise, and those of emperor William I and Empress Augusta.

History.—First called Lietzenburg, after the castle erected by Sophie Charlotte in 1695–1699, the town was issued a charter in 1715. The castle was the favorite of a long line of rulers, and was later renamed in honor of its builder. The town's growth expanded rapidly in the beginning of the 20th century and in 1920 Charlottenburg was incorporated into Greater Berlin (Stadt Berlin). The entire district suffered severe damage from air raids and hand to hand fighting during World War II. Pop. (1946) 208,453.

CHARLOTTESVILLE, city, Virginia, seat of Albemarle County, at an altitude of 500 feet, 70 miles west of Richmond, on the Southern and Chesapeake and Ohio railroads and state and federal highways. It lies in a rich agricultural, apple and cattle raising section, famous as the home of Albemarle pippin apples. Industries include woolen and silk mills, underwear, shirt, dress, and drapery factories, and a law book publishing house. The University of Virginia, founded (1819) and planned by Thomas Jefferson and Monticello, Jefferson's home, are located in or near the city. The site of Charlottesville was settled about 1737 and named in 1762 for George III's queen. It became a town in 1851 and a city in 1888. It is governed by a city manager and council. Pop. (1950) 25,969.

CHARLOTTETOWN, city, Prince Edward Island, Canada, capital of the province situated on a commodious harbor formed by the confluence of three navigable rivers on the southern shore of the island (Northumberland Strait). It was founded by the French as Port La Joie in 1750, but was renamed after the British conquest from the consort of King George III. Charlottetown is the industrial, commercial, and educational as well as political center of this the smallest of the Canadian provinces. Its industries, of a miscellaneous character, employ about 600 persons and have an output of \$7 million, including the workshops of the Prince Edward Island Railway and of the airport. In addition to four grade schools and two business colleges, the educational institutions include the provincially supported Prince of Wales College and St. Dunstan's College (Roman Catholic). Charlottetown has several large churches, two hospitals, a provincial sanatorium, and the Falconwood (provincial) Mental Hospital. In the attractive legislative buildings of the province is a plaque which commemorates the holding here in 1864 of the first conference of political leaders to discuss the project of the confederation of the British American colonies into the Dominion of Canada. Pop. (1951) 15,887.

CHARLTON, John, Canadian statesman: b. near Caledonia, N. Y., Feb. 3, 1829; d. Lynedoch, Ontario, Feb. 11, 1910. He was educated at the Springville Academy, went to Ontario in 1849. He was for some years a farmer and merchant, and acquired a fortune in the lumber business. In 1872 he was elected to the House of Commons as a Liberal. He attracted attention through his knowledge of trade and tariff questions and advocated government intervention in private and public morality. He supported the Conservative premier during the crisis of the Kiel Rebellion in 1885. He secured the passage of various laws for the protection of women and girls and was an advocate of reciprocity with the United States.

He wrote a volume of *Speeches and Addresses* which was published in Toronto in 1905.

CHARM, anything believed to possess some occult or supernatural power, such as an amulet, spell, potion, or precious stone, but properly applied to spells couched in formulas of words or verse.

Among celebrated charms the Danish Hane brog, or national banner, stands prominent. This banner was said to have been woven in a day and a night by three daughters of a celebrated Norse chieftain, of the race of Ynglings said to be descended from the god Odin. These girls were deeply versed in the lore of the gods, giants, dwarfs and norns, and in the centre of the banner they placed a raven, the bird of Odin, wonderfully lifelike and realistic. The superstition was that the result of a battle was foretold by this raven, which if victory was to fall to the possessors of the banner, held its head and bill in an upright position. By observing this banner the Danes in three years' time had won 27 important battles, going into action only when the raven looked skyward. If the bird looked droopy and held its head low, they remained in camp, or, if in action, and the attitude of the raven suddenly changed, they withdrew from the field. Alfred the king of the English Saxons, noting the enthusiasm which this banner inspired in the Danes determined to capture it, and succeeded after a savage battle in which the Danes fought desperately for three hours. When, however, it fell into the hands of the Saxons, and the head and wings of the raven drooped, there was a general rout. The Danes were models of courage and bravery so long as superstition fanned the fire of faith in their hearts, but they were arrant cowards the minute they realized that their idol was powerless to protect them. Another curious charm is to be seen in the National Museum at Washington. This is a necklace of human fingers which was captured from the Sioux Indians in 1876, the loss of which brought about the subjection of the Indians.

The word charm is also used to denote attractive personal or physical characteristics.

CHARMES, shârm, Francis, French editor: b. Aurillac, Cantal, April 21, 1848; d. Paris, Jan. 4, 1916. He was educated at the College of Aurillac and at the lycées of Clermont-Ferrand and Poitiers. In 1872–1880 and 1889–1907 he was editor of the *Journal des Débats* and from 1907 he edited the *Revue des Deux Mondes*. He also held various public offices, principally in the Department of Foreign Affairs, was deputy for Cantal in 1881–1885 and 1889–1898 and senator in 1900. He was

ected to the academy in 1908. He published *Études historiques et diplomatiques* (1892) and numerous literary and political articles in his editorial capacity.

CHARMIAN, kār'mī-ān, or **CHARMION**, an attendant on Cleopatra in William Shakespeare's *Antony and Cleopatra*. After Cleopatra's suicide, Charmian killed herself.

CHARNAY, shār-nā', **Claude Joseph Désiré**, French traveler and archaeologist: b. Fleurioux (Fleurie), Rhône, France, May 2, 1828; d. Paris, Oct. 24, 1915. From 1857 to 1861 he traveled in Mexico for the French Ministry of Education and went on a number of expeditions to North and South America, Australia, and other countries. In 1880 he conducted an expedition to the ruined cities of Mexico. Charnay revisited the Mayan ruins of Yucatán in 1886. Among his publications are *Le Mexique: souvenirs et impressions de voyage* (1863); *Les anciennes villes du nouveau monde* (1885; Eng. trans. 1888); *Histoire de l'origine des Indiens qui habitent la nouvelle Espagne selon leurs traditions* (1903).

CHARNEL HOUSE, a chamber or building under or near churches, where the bones of the dead are deposited. In England the crypts of some churches were formerly used as charnel houses.

CHARNOCKITE, chār'nōk-it, name for a series of igneous rocks containing hypersthene and including, apart from hypersthene-granite (gneiss), other basic and ultrabasic types, among which are norites and pyroxenites. Charnockite, first described by Sir Thomas Henry Holland, is called after Job Charnock (d. 1693), the founder of Calcutta, India, whose tomb is made of a variety of such rock.

CHARNWOOD, chār'nwōd, 1st **CHARON** (GODFREY RATHBONE BENSON), English biographer and political leader: b. Langtons in Alresford, Hampshire, England, Nov. 6, 1864; d. London, Feb. 3, 1945. Educated at Winchester and at Balliol College, Oxford, where he was a one-time lecturer, he served as a liberal member of Parliament (1892-1895) with the sole purpose, as he claimed, of espousing Irish home rule. He was mayor of Lichfield from 1909 to 1911 and continued as councilor and alderman until 1938. In 1911 he was made a peer. Lord Charnwood attained renown for his biography *Abraham Lincoln* (1916), which was for long the most popular and authoritative one-volume work on the American president. He also wrote a life of *Theodore Roosevelt* (1923). Other publications include *According to St. John* (1926) and *Tracks in the Snow*, a detective story, reissued in 1927.

CHARNWOOD FOREST, wooded district, England, located in northwestern Leicestershire, about 15 miles south-southwest of Nottingham. With rugged terrain it rises gradually to its most elevated point, Bardon Hill, which is 912 feet high. There are granite quarries and some coal mines.

CHARNY, shār-nē', village, Quebec, Canada, located in Levis County, about 8 miles southwest of Quebec. It is washed by the Chaudière

River. An important divisional point of the Canadian National and Quebec Central railways, it has major railway repair shops. Pop. (1951) 3,300.

CHARON, kā'rōn, in classic mythology the son of Erebus and Nyx (Night), generally represented as a somewhat coarse, bearded, old man. It was his office to ferry the dead in his boat over the dark waters of the underworld. Each of the shades was obliged to pay him an obol, which was put at the time of the burial into the mouth of the deceased.

The traditions relative to Charon arose after the Homeric age, and it is thought that the myth was imported into Greece from Egypt. Charon is a familiar figure in literature after the 5th century B.C. The Etruscans seem to have associated him with all the horrors of death and depicted him with bestial face. Modern Greeks preserve the tradition in the figure of Charos or Charontas, the black bird or winged horseman, who carries people to the afterworld.

Consult Waser, O., *Charon, Charun, Charos* (Berlin 1898); De Ruyt, F., *Charun* (Rome 1934).

CHARONDAS, kā-rōn'dās, ancient Sicilian lawgiver, a native of Catana (modern Catania), flourished 6th century B.C. Of aristocratic background, he is said to have been a disciple of Pythagoras. He composed laws, probably in verse, which were adopted by some of the Greek-Chalcidic cities of southern Italy and Sicily, particularly Rhegium (modern Reggio di Calabria), and which won for their judiciousness and exactitude high praise from Aristotle in his *Politics*. According to legend he committed suicide, because he had violated one of his own laws.

CHAROPHYCEAE, kā-rō-fi'sē-ē, a class of algae, whose seven-member genera, *Chara*, *Nitella*, *Tolypella*, *Lychnothamnus*, *Lamprothamnion*, *Nitellopsis* and *Protochara*, are grouped in a single family, Characeae. The Charophyceae are classified currently by phycologists either in a separate division of the plant kingdom, the Charophyta, or as a class coordinate with the class Chlorophyceae, the green algae, under the division Chlorophyta. These divergent practices are representative of current views of their relation to other algae (q.v.). Although they possess pigments, storage photosynthate (starch) and flagellation similar to those of the Chlorophyceae, whatever their taxonomic disposition may be, they differ in the following morphological respects from other green algae. Their plant bodies, which are slender axes with whorls of branches (often called "leaves"), are in a majority of cases larger and coarser than those of Chlorophyceae; they may attain a length of five to six feet; the main axes may also be branched. Their nodal and internodal and verticillate construction, superficially suggestive of certain species of horsetails, *Equisetum*, are absent in Chlorophyceae, except in a few genera. Furthermore, the complexity of the axes, in those species in which nodal cells grow down as corticating layers, is unparalleled among the Chlorophyceae. Finally, the sex organs of the charalean genera are characteristic and unique and unlike those of other green algae.

Because certain species, especially of *Chara*, regularly become incrustated with lime (calcium carbonate), they are sometimes called "stone-

worts" or "brittleworts." Charalean genera grow in a variety of habitats, including lakes, ponds, quarries, sometimes in shallow water and sometimes in water as deep as 28 feet. The physical attributes of charalean habitats are variable: the bottom may be mucky, sandy, or rocky; various species have been found in slightly acid waters (at pH 5.7, *Nitella morongii*, for example) and in those which are markedly alkaline (pH 9.5, *Chara delicatula*).

Although a majority are freshwater forms, some flourish in markedly brackish water. In certain stations the plants seem to be not only seasonal in their development but also relatively ephemeral; in others, they have been observed to recur for more than 50 years. There is good evidence that the 292 recognized species of charalean algae vary in their tolerance of and requirements for special environmental conditions. Several species are cultivated in aquaria as agents of oxygenation.

The verticillate organization, large size, and complexity of the plants have been noted. Their development may be traced to the activity of a prominent, dome-shaped, apical cell, from which nodal and internodal segments are cut off with marked regularity. The elongate internodal cells are multinucleate and may or may not be covered with cortical cells, which originate from the node above and below; the internodal cells of Charophyceae are classical objects for observation of protoplasmic streaming. The plants are anchored to the substratum by branching, filamentous rhizoids.

Reproduction, other than by fragmentation of the plants and rooting of the fragments, is accomplished sexually. Sexuality is oogamous (involving large, nonmotile eggs and small, motile sperms, as in most animals). A majority of species are homothallic (male and female sex organs borne on the same individuals). The stalked sex organs are produced as short protuberances from the lateral branches or leaves and are sometimes clustered in homothallic species. The oogonium, the egg-producing organ, contains a single egg cell, whose cytoplasm is densely filled with starch and other stored metabolites; it is surrounded by a single layer of spirally twisted cells, the tube cells, whose apices are delimited to form a group of crown cells. The male organ, the antheridium, is somewhat globose and complex in organization. Its surface is composed of eight shield cells which become reddish orange at maturity. Attached to the inner surface of each of these is a radially elongate cell, the manubrium; the manubria bear somewhat isodiametric cells, the capitula, at their inner poles; from these branching, colorless rows of cells the antheridial filaments are generated. Each cell of the latter produces a single sperm, which at maturity is liberated through a pore from its mother cell and through fissures between contiguous shield cells.

The biflagellate sperms reach the egg through small passageways, developed by slight separation of the tube cells just below the crown. Parthenogenetic plants, whose eggs develop without fertilization, are known. The fertilized eggs, zygotes, become dark colored and are shed ultimately from the parent plant; the inner walls of the tube cells, adjacent to the oogonial surface, persist and thicken and are present as spiral markings on mature zygospores in both living and fossil charalean genera. Following a period of dormancy, the zygospores germinate into young plants. Meiosis probably occurs at zygospore germination. See also PLANTS AND PLANT SCIENCE—Classification, Morphology, and Evolution (Algae and Fungi).

Consult Fritsch, F. E., *The Structure and Reproduction of the Algae*, 2 vols. (Cambridge 1935-45); Smith, G. M., *Fresh-water Algae of the United States*, 2d ed. (New York 1950); Wood, R. D., "The Characeae, 1951," *The Botanical Review*, 18:317-353 (1952).

HAROLD C. BOLD,
Vanderbilt University.

CHAROST, shā-rō', DUKE OF. See BÉTHUNE.

CHARPENTIER, shār-pān-tyá', *Gustave*, French composer: b. Dieuze, Lorraine, France, June 25, 1860. After studying at the conservatory of Lille, he was a pupil of Émile Pessard

and Jules Massenet at the Paris Conservatory. For his cantata *Didon* he won the Grand Prix de Rome in 1887. In Italy he wrote *Napoli*, a symphony, *Impressions d'Italie*, an orchestral suite, and *La vie du poète*, a symphonic drama produced at the Grand Opéra in 1892. His greatest and most notable work was, however, *Louise*, an opera produced at the Opéra Comique in 1900. The libretto, frequently ascribed to the composer, was by Saint-Pol-Roux (Paul Roux). *Louise* was presented also in Germany, England, and the United States with great success. A second opera, *Julien* (1913), failed. Besides three operas, *Marie*, *Orphée*, and *Tête rouge*, Charpentier set to music poems by Charles Baudelaire and Paul Verlaine. He was elected to the French Academy of Fine Arts in 1912.

CHARR, genus of fishes. See CHAR.

CHARRAN, ancient Mesopotamian city, now in Turkey. See HARAN.

CHARRON, shā-rōn', *Pierre*, French Roman Catholic theologian and philosopher: b. Paris, France, 1541; d. there, Nov. 16, 1603. After studying law at Orléans and Bourges, he practiced for six years as a parliamentary advocate and then turned his attention to theology. Gaining much fame by his sermons, he was appointed court chaplain to Queen Margaret, the wife of King Henry IV of France, who protected him on several occasions. Charron went in 1589 to Bordeaux and became very intimate with Montaigne, who influenced him considerably. His principal works are *Traité des trois vérités* (1594) and *Traité de sagesse* (1601). The dogmatic zeal of the former drew upon him the rebuke of Philippe de Mornay (Duplessis-Mornay), the Huguenot leader, while the latter's pessimism and skepticism exposed him to a charge of atheism and led to official condemnation of the treatise.

CHARRUAS, chār-rōō'áz, a fierce, now virtually extinct, dark-skinned Indian people of South America inhabiting present-day Uruguay and parts of southern Brazil. They lived by hunting. Expert horsemen, and of sullen temperament, they long resisted European colonization of the area.

CHART. The term as used herein is restricted to maps used for navigation, but it is also used for any graphic delineation of statistical or other scientific material, such as charts of production, charts showing organization of government, and time charts of history. For these see DIAGRAM. The word "chart" comes from Greek *chártēs* and Latin *carta*, meaning "leaf of papyrus," "paper."

History.—The history of charts is almost as old as the history of maps. Indeed the first scientific maps were made by navigators, and the fundamental principles of geography, such as the size, shape, motions of the Earth, latitude and longitude were first defined for their use in navigation. The ancient Greek *portolanos*, or harbor book, was probably accompanied by charts, and we can safely assume that the ancient Phoenicians had good charts, as we have positive knowledge of the chart of the *oekumene* (habitable world) by Marinus of Tyre of about 100 A.D., from Claudius Ptolemy, who often referred to it.

The most important chart of history is the portolan chart of the Middle Ages. This famous chart delineates the coast of the Mediterranean with surprising accuracy. Its first copy dates from 1300 (Pisa) and it was copied over and over again with some modifications until 1620. So good was this chart that it was used for actual navigation for over three centuries.

The famous maps of the Great Discoveries, such as the Juan de la Cosa map of 1500 and the Ribero map, could be called charts rather than maps, as their emphasis was more on the sea than on the land. The first atlas of charts is *Spiegel der Zeaveardi* of Lucas J. Waghenar, published in 1584. The Dutch were the leaders in chart making during the 17th century. After the *Neptune François* of 1693 the best charts came from Paris, which in turn was eclipsed by London in the second half of the 18th century. The *English Pilot*, the charts of Joseph F. W. Des Barres, Thomas Jefferys, and others represented the high tide of private chart making. Private undertaking, however, was unable to cope with the demands of the navy, and the Royal Hydrographic Office was founded in 1795. Since that time, the British Admiralty has been the leading producer of charts the world over.

The United States Coast Survey was founded in 1807 and was organized under Ferdinand Hassler, a Swiss cartographer. The first charts appeared in 1845, and since then charts of all the coasts of the United States and its dependencies have been produced. As this office also provides first- and second-order triangulation for all surveys of the United States, its name was changed in 1878 to United States Coast and Geodetic Survey after the great transcontinental arc of triangles from Atlantic to Pacific was carried through. See COAST AND GEODETIC SURVEY, UNITED STATES.

Charts of foreign waters are published by the United States Hydrographic Office of the Navy Department, founded in 1806. This is done partly by compilation, partly by original surveys. This office also publishes the monthly *Pilot Charts*. Other charts deal with earth magnetism, astronomy, great circle navigation (gnomonic charts). Both offices publish charts for aerial navigation (airway maps). See HYDROGRAPHIC OFFICE, UNITED STATES.

The charts of the Great Lakes are prepared by the Survey of the Northern and Northwestern Lakes of the Corps of Engineers (founded 1841). The charts of the Mississippi River are periodically published by the Mississippi River Commission in Vicksburg, Miss.

Among the other nations, France, Germany, the U.S.S.R., Japan, Netherlands, Denmark, Spain, Portugal, Italy, Norway, and Chile are the most important producers of charts.

Scales and Projections.—Charts, unlike topographic sheets, are published on very variable scales. The reduction of general charts of the seas and oceans goes into millionths; coast charts show a mile in 1–10 inches, while harbor charts have still larger scales. Coasts are of widely different importance, and uniformity of scale is not practical. The prevailing Mercator projection in itself would preclude such uniformity. Indeed the scale is not even given on small-scale Mercator charts, but can be read on the side margins: 1 minute of latitude equals 1 nautical mile.

The preference for the Mercator projection

is due to the unique property of this network: that it shows compass directions (rhumb lines) as straight lines, and it makes plotting of courses easy. If we place an evenly divided compass rose or protractor over any point of the map, the rhumb lines (loxodromes, compass azimuths reckoned from true north) will have the correct bearing.

The gnomonic projection shows great circle directions as straight lines, and gnomonic charts of each ocean are published, for plotting trans-oceanic routes. For actual navigation, these great circle sailing routes are transferred to Mercator charts. The United States Coast and Geodetic Survey published some charts in the polyconic projection because the geodetic positions were plotted on polyconic base sheets.

Symbols.—The symbols of charts are the result of long development and are much the same the world over. The detail of land areas is shown only as far as visible from the sea, or as it has any bearing on harbors or navigation. Buoys, lights, shoals, rocks, signals, piers, landings, harbor facilities, dredged channels, anchorages, and types of bottom are recorded by an elaborate set of symbols or abbreviations. Soundings are often recorded in feet in shallows, and in fathoms in deep water, and meters are used in foreign charts. Datum plane for soundings is mean low water (mean lower lows in the Pacific). On very variable tides a still lower level may be chosen. Heights are usually reckoned from mean high water level, as this line is clearly visible. Charts usually give information about tides and currents. Compass roses have usually an outer dial divided in degrees reckoned from true north and an inner dial divided in points ($11\frac{1}{4}^\circ$) counted from magnetic north. Isogonic lines are also shown.

Marine Surveys.—These surveys have been greatly facilitated by echo sounding and by airplane photography. Intricate shore lines of coral or mangrove can now be plotted with ease and great accuracy. The location of the surveying vessel is obtained by radio acoustic sounding in which a sound signal from the vessel releases radio signals from two shore stations of known location. See SUBMARINE SIGNALING.

Pilot Charts.—Published monthly by the United States Hydrographic Office and separately for each ocean, these charts show winds, currents, isogonic lines, storm tracks, floating icebergs or derelicts, sailing routes and give a wealth of information on oceanographic data.

Aeronautical Charts.—These charts or airway maps are usually on the scale of 1:500,000 or 1:1,000,000, and most are on Lambert conformal conic projections, which, within the limited area of a sheet, have fairly good azimuths. The charts show roads, railways, cities, rivers, and easily visible land marks. Relief is shown by 1,000-foot contour lines and altitude tints in conventional colors. All information pertaining to flying, such as airports, landing fields, radio beacons, and signals are overprinted, usually in red. Airway maps are published either in the form of regular sections or showing strips about 80 miles wide. In the United States, the Hydrographic Office, the army, and the Coast and Geodetic Survey all publish airway maps. See also MAP; NAVIGATION.

ERWIN RAISZ,
Lecturer on Cartography, Institute of Geographical Exploration, Harvard University.

CHARTER, a document by which a sovereign power grants permanent or continuing rights and privileges to a person or persons, corporation or institution, colony or municipality. Originally it had the broader sense, now obsolete, of a conveyance of land. The medieval charters ranged from a grant of political rights by a sovereign to an entire people—like the Magna Carta (q.v.) or Great Charter of England—or to a section of the country (for example, the *Charte aux Normands*, setting forth the privileges granted to the Normans in 1315 by King Louis X of France), down to permissive acts for abbeys and colleges or trading companies (see **CHARTERED COMPANIES**). The French Constitution of 1814, granted by Louis XVIII on the restoration of the monarchy, is known as the *Charte* or the *Charte Constitutionnelle*. In modern usage the term is generally restricted to the charters of municipalities, corporations, and institutions, with the major exception of the Charter of the United Nations (see **UNITED NATIONS, THE**).

Colonial Charters.—The charters for the American colonies were usually distinguished from patents by the granting of specific privileges of jurisdiction and legislation and, in general, the powers needed to establish and continue a self-regulating community, instead of mere general grants of land and rights of settlement. The two terms were, however, often used loosely as interchangeable. Thus, in acknowledging receipt of their charter in 1662, the Connecticut officials acknowledged also the "old charter," meaning the Warwick Patent. Strictly speaking, all the colonial charters were patents, as granted by the king under letters patent, but in usage only (1) the grants to individuals were commonly termed patents, the word charter being reserved for (2) those to companies and (3) those to colonies already established. Of the three types, the first includes the patents to Cecilius Calvert, 2d Baron Baltimore, for Maryland in 1632; to Sir Ferdinando Gorges for Maine in 1639; to the duke of York (later James II) for New Netherland (New York) in 1664; and to William Penn for Pennsylvania in 1681. The second comprises those to the Virginia Company in 1606, 1609, and 1612; the Plymouth and London companies in 1606; the Council for New England in 1620; the Massachusetts Bay Company in 1629; the proprietors of Carolina in 1663; and the trustees of Georgia in 1732. Included in the third class are Rhode Island (1643; superseded 1663) and Connecticut (1662). The legal nature of these documents was keenly disputed. According to the English view, they were concessions granted by the government for political reasons and revocable at its pleasure; the title to the lands as well as to political privileges lay with the government, and its right to vacate either was limited only by policy; and charter governments had only such powers as were specifically given them in the charters. The colonial view was that the charters were compacts between the government and the colonies, in consideration of the latter having cleared and taken possession of the territory and annexed it to the crown; and that the crown possessed only political rights there, the land title being derived from purchase and occupation and the colonists' own courage and labor. See also **COLONIAL GOVERNMENT, PROPRIETARY**.

Municipal and Private Charters.—In the United States charters are granted by acts of the several state legislatures or by the national gov-

ernment. The act by which a municipality is organized is termed a charter. It is distinguished from a private charter, however, in that it is not a contract; the municipality has no vested rights; and the charter can be altered or repealed at any time by the legislature. A private charter, on the other hand, is a contract which cannot be repealed or modified by the public power unless such liberty has been expressly reserved in the charter itself. See also **CORPORATIONS, LEGAL—Charter; DARTMOUTH COLLEGE CASE, THE**.

CHARTER OAK, a tree nearly seven feet in diameter, formerly in Hartford, Conn., which blew down in a storm on Aug. 21, 1856, when its age was computed to be nearly 1,000 years. A section of its trunk was preserved in the rooms of the Connecticut Historical Society; the remainder—believed to rival in miraculous powers of reproduction the loaves and fishes or the *Mayflower* furniture—was kept or sold for small souvenirs. It is thus venerated from a tradition, first accredited to it in 1789, that in a hollow of it was concealed the charter of Connecticut rescued from Sir Edmund Andros (q.v.) in 1687; earlier ones specify an elm, others the houses of different persons. This is of little moment, but the adventures of the charter form a mystery which investigations, instead of illuminating, render utterly insoluble. The contradiction of unquestionable facts is absolute. The story without these is sufficiently peculiar. James II, wishing to make Connecticut a part of his consolidated New England under Andros, found its charter in the way; and as the colony declined to surrender it, he brought writs of quo warranto to vacate it, the last of which was returnable in February 1687. To delay or avoid voluntary surrender, yet escape forfeiture and entire outlawry of rights, the colonists replied that they would much rather stay as they were, but if they could not, preferred a provincial union under Andros over annexation to any other province. The council chose to consider this a formal waiver of charter rights, and dropped proceedings under the writ; and on Oct. 31, 1687, Andros rode over from Norwich to Hartford, under orders to assume the government. Calling the governor and council together, he demanded surrender of the charter according to their dutiful assurances. The meeting was secret; what happened we learn only from tradition and the brief account of an intimate friend of the actors. The colonial officials protested and debated until after dark; that this was prearranged is not only morally certain in itself, but Benjamin Trumbull's account of a long speech by the governor, to no conceivable purpose otherwise, deepens the certainty. Candles were lighted; the charter was (or the charters were) at last brought in and laid on the table; suddenly some officious candle snuffers put out all the lights, and when they were relighted no charter was to be seen. But if Andros had no longer a charter to suppress, equally the colony had no longer one to appeal to; the old government was just as effectually extinguished as if they had let him have the paper; they cannot have foreseen a revolution in England, and it is not evident what they intended to do with it. Most likely, from their previous actions, it was merely to save their face from the humiliation of a formal surrender. There was no outcry by Andros, no charge made against the officials, no appearance of ill will to them, no report of the affair to England, seem-

ingly no disclosure of it to the train of Massachusetts magnates who accompanied him (and may or may not have attended the meeting), or to anyone else; and (perhaps the most curious of all the circumstances of this curious affair) both our informant and tradition stop short at the relighted candles and the missing document, and give no hint what Andros said or if he said anything, or whether he seemed puzzled or offended, or any of the immediate sequelae of the business. The governor, Robert Treat, had called a meeting of the General Court, which accepted the situation and the annexation; the secretary inscribed it on the colonial records and wrote "Finis" on them; and the next day Andros publicly proclaimed his commission. When James was overthrown and Andros with him, the colony resumed its government, appealed to its charter brought from hiding, and the English authorities admitted without trial that it had never been vacated. But that was chance and not foresight. This, however, is only the beginning of mystery. The charter, obtained by Gov. John Winthrop from Charles II's council in April 1662, was engrossed in duplicate, and the official fees are entered on the English records. No other copies were made, nor could have been unless both the others were lost; and neither was lost. The first copy was sent to the colonial government, which acknowledged receipt of "the charter, the duplicate and the old copy of the former charter [that is, the Warwick Patent]." Duplicate of what? It is usually assumed to mean of the charter; but the facts to be cited prove that it was of the patent. Winthrop was to bring over the duplicate of the charter with him and a legislative committee was appointed to receive it from him. That he did not is conclusively shown by a letter from the colony to its agent, William Whiting, in 1686, instructing him to obtain it from James Porter in London, with whom Winthrop had left it, and use it in defending the colony's rights before the council. That Winthrop may have taken it across once more on official business, and left it there, is barred out by the fact that he never visited England again. That Whiting sent it back within the next year is equally negated by the fact that he continued to need it there and the colony did not need it at all, that he would not have sent it without orders and they gave him no such orders, and that in his correspondence there is no letter of transmittal. Furthermore, a legislative committee of 1715 voted a money acknowledgment to Joseph Wadsworth for safely preserving the "Duplicate Charter" when "our constitution was struck at." It is absurd to suppose they made him the grant for preserving a second copy when they had one safe already. Obviously, the one he preserved was the only one they had. On the other hand, Roger Wolcott, the first narrator (1759), distinctly says that "the charters were set on the table," and that when the candles were relighted the charters were gone. Still more specifically, President Ezra Stiles of Yale writes in his *Itinerary*, as from Wolcott, that Nathan Stanley took one copy and Governor Joseph Talcott's father the other. Wolcott was only eight at the time; but by 1714 he was in the council, in 1715 was on the very committee which made the grant to Wadsworth, and was certainly intimate with many who were present at the scene and probably helped arrange it. We have, then, the certain fact that there was but one copy of the charter in America in 1687.

set against the positive assertion of one who must have known, that two were abstracted. Still a third mystery is that Wadsworth was not present at the meeting and could not have taken the paper; that Wolcott, who publicly honored Wadsworth as the savior of the charter, privately gives all the credit to others and does not even mention Wadsworth, and that the names of the persons he cites are really those of members present; and that if one of the actual abstracters passed it to Wadsworth waiting outside, he and not they should receive public acknowledgment. We can guess at solutions to these problems, but all solutions are guesses alike.

ALBERT C. BATES,

Librarian Emeritus, Connecticut Historical Society.

CHARTER PARTY, a contract executed by the freighter and the master or owner of a ship, containing the terms on which the ship or a principal part thereof is hired to freight. The master or owner usually binds himself that the goods freighted shall be delivered (dangers of the sea excepted) in good condition at the place of discharge, and agrees also to equip the ship complete and adequate to the voyage. The charterer is bound to furnish the cargo at the place of lading and to take delivery at the port of discharge within a specified period.

CHARTERED COMPANIES, trading companies which came into existence as a result of special charters granted to them by the sovereign authority of the state. The charters usually granted the companies (which sometimes were state supported) well-defined rights and privileges; stated the localities in which the rights were to be exercised; and imposed certain obligations on the companies thus created. The earlier companies were generally either associations of merchants engaged in foreign trade, or the agencies through which colonization projects were carried out. As such, they played a large part in the overseas expansion of the European nations, enabling the expense of long journeys to little-known places to be shared among the stockholders in the enterprise. Their reward was the monopoly of trade with a certain area, and in that area they exercised legislative, military, and diplomatic powers.

In England the first charters were granted to branches of the Hanseatic League (q.v.), which traded in England for 700 years until the Steel-yard in London was closed by Queen Elizabeth I in 1598. The origin of the English companies is found in the Merchants of the Staple, an association primarily interested in exporting wool, which remained in existence until the 18th century. The largest of the early companies was the Merchant Adventurers (1359), a development of the early trade guilds (see **MERCHANT ADVENTURERS, THE COMPANY OF**).

The chartered company in its more modern sense developed mainly during the 16th century, notable examples being the Eastland (1404), Muscovy (1555), Levant (1581), English East India (1600), Dutch East India (1602), and Hudson's Bay (1670) companies (see **EAST INDIA COMPANIES; HUDSON'S BAY COMPANY, THE**). In France, from 1599 to 1770, when the French East India Company (founded in 1664) was dissolved, more than 70 companies were established. Spanish companies, trading with Cen-

tral America and the West Indies, were formed in the first half of the 18th century.

Much of the early colonization of the Western Hemisphere was undertaken by companies chartered for the purpose, among them the Dutch West India Company (1621; see DUTCH WEST INDIA COMPANY, THE), the Massachusetts Bay Company (q.v., 1629), the French Royal West India Company (1664), and the Santo Domingo Company (1698). The Plymouth Company (see PLYMOUTH COMPANY, THE) and the London Company (q.v., later the Virginia Company) were granted charters in 1606 by James I to locate colonies in North America, and Jamestown, the first permanent English settlement in North America, was founded by the London Company in 1607.

By the middle of the 19th century these companies had largely disappeared, the English East India Company being finally dissolved in 1874. During the last 20 years of the 19th century, however, there was a revival in Europe, notably in Great Britain, of the system of chartered companies for trading and colonization purposes. These companies were not privileged or monopolistic in the sense that the 16th and 17th century companies were, and their sovereignty, being subject to the control of the home governments, was limited. Their main achievements lay in opening up the territories in which they operated, developing trading facilities, and laying foundations of settled administration. It has been estimated that in Africa alone they added about 1,700,000 square miles of territory to the British Commonwealth. The most notable of these later companies were the North Borneo (1881), Royal Niger (1886), British South Africa (1889), and German East Africa (1884) companies, all of which have since been liquidated.

Consult Cawston, George, and Keane, A. H., *The Early Chartered Companies* (London 1896); Hannay, David, *The Great Chartered Companies* (London 1926); *The Cambridge History of the British Empire*, 8 vols. (Cambridge, England, 1929-36); Lipson, Ephraim, *The Economic History of England*, vol. 2, chap. 2, 4th ed. (London 1947).

CHARTERHOUSE, a celebrated school and charitable foundation, Godalming, Surrey, England. In 1371, Sir Walter de Manny (q.v.) built and endowed in London a priory for Carthusian monks—hence the name, which is derived from *maison Chartreuse*, a religious house of the Carthusian Order. After the dissolution of the monasteries (1535) it passed through several hands until it came into the possession of Thomas Sutton, who, in 1611, obtained letters patent from James I and converted it into a hospital, richly endowed, consisting of a master, a preacher, a head schoolmaster, and 40 "poor scholars" (boys) and 80 "indigent gentlemen," together with a physician and other officers and servants. The pensioners, "poor brethren," must be over 50 years of age and members of the Church of England.

The school was removed to new buildings near Godalming in 1872, and since then the scholars have been selected by examination instead of being nominated by the governors, as laid down in the original charter. In 1953 there were 60 scholarships, the remainder of the 600 students at the school paying fees of £300 a year. The special garb of the scholars has been discarded, and Charterhouse is one of the great public schools of England. Among the famous men who

received their education at Charterhouse were Isaac Barrow, Joseph Addison, Sir Richard Steele, John Wesley, Sir William Blackstone, George Grote, Connop Thirlwall, Sir Henry Havelock, John Leech, and William Makepeace Thackeray (qq.v.). Charterhouse and one of its poor brethren, Colonel Newcome, were immortalized by Thackeray in *The Newcomes*.

In 1939 the pensioners, 60 in number, were also moved to Godalming, and no new ones were admitted since that date. By 1950 their numbers had been reduced to 13.

Consult Haig Brown, William, *Charterhouse Past and Present* (Godalming 1879); Taylor, W. F., *The Charterhouse of London* (London 1912); Kent, William, ed., *An Encyclopaedia of London*, new rev. ed. (New York 1951); *The Public and Preparatory Schools Year Book* (London, annually).

CHARTERS TOWERS, city, Australia, situated in Queensland, near the Burdekin River, 75 miles southwest of Townsville, with which it is connected by rail. There are copper, silver, and gold mines nearby. First settled in 1871-1872, when gold was discovered in the area, Charters Towers was incorporated in 1877. Pop (1947) 7,561.

CHARTIER, shâr-tyä', Alain, French writer and diplomat: b. Bayeaux, France, 1385?; d. Avignon, after 1433. Educated at the University of Paris, he entered the service of the dauphin (later Charles VII) in 1418, becoming secretary of the royal household in 1422. Between 1424 and 1428 he was employed on various diplomatic missions, including one to Scotland in 1427 to make arrangements for the subsequent marriage of Margaret of Scotland and the dauphin (later Louis XI). An ardent patriot, he wrote *Le livre des quatre dames* (1415), *Quadrilogue invectif* (1422), *Traité de l'espérance* (1428), and other works to rally the French in support of the royal house, whose fortunes had been in eclipse since Agincourt (1415). Of more enduring value is his graceful poetry, including *Lai de plaisance* (1413-1414), *La belle dame sans merci* (1424) and *Bréviare des nobles* (c. 1424).

Consult Hoffman, E. J., *Alain Chartier* (New York 1942).

CHARTIER, Émile Auguste (pseudonym ALAIN), French philosopher and essayist. b. Mortagne, France, March 3, 1868; d. Le Vésinet June 3, 1951. Educated at the École Normale Supérieure, he became a professor of philosophy at the Lycée Henri IV in Paris, and through his teaching and extensive publications exercised a wide influence on French thought in the years between World Wars I and II. His most characteristic work was the *propos*, a short, aphoristic essay embodying his views on ethics, which emphasized the importance of the individual conscience and of resistance to power. Collections of *propos* include *Les propos d'Alain* (1920), *Propos de littérature* (1933); and *Propos de politique* (1934). Among Chartier's other published works are *Le citoyen contre les pouvoirs* (1925); *Les idées et les âges* (1927); *Les dieux* (1934); *Histoire de mes pensées* (1936); *Souvenirs de guerre* (1937); and *Les saisons de l'esprit* (1937).

CHARTISM, a 19th century English working-class movement whose primary purpose was the attainment of certain political reforms. The

Reform Bill of 1832 had failed to bring expected advantages to the working class; the Poor Law Amendment Act of 1834 was unpopular; and a period of general commercial depression and a succession of bad harvests had produced widespread suffering. The resultant discontent found expression in the People's Charter, a document prepared by a committee of workingmen and members of Parliament and published in 1838. Reforms were demanded under six heads: (1) universal suffrage, or the right to vote conferred on every male 21 years of age or over, of sound mind, unconvicted of crime, and a native of the United Kingdom, as well as on every foreigner possessing the same qualifications, who had resided in the United Kingdom for more than two years; (2) equal electoral districts; (3) vote by ballot; (4) annual Parliaments; (5) no property qualification for members of Parliament; and (6) payment of members of Parliament.

At first some members of the middle class supported the movement, but they became estranged from it, and the Chartists became more and more a distinctively working-class group. The movement was not purely political, for it also aimed at the improvement of general social conditions. Joseph Rayner Stephens, one of its leaders, is quoted as saying: "Chartism is no political movement where the main point is gaining the ballot. . . . The Charter means a good house, good food, prosperity, and shorter working hours." Immense meetings were held throughout England, and popular excitement was high. Some of the Chartists advocated physical force as the only effectual means of obtaining their demands. Meanwhile, in June 1839, a petition in favor of the charter, signed by 1,280,000 persons, was presented to the House of Commons, which rejected it on July 12. The Chartists became increasingly exasperated, and in November 1839 a riot took place in Newport, in which a number of persons were killed and wounded. In 1842 there were serious riots in the north and the Midlands. A great demonstration was planned in London in 1848, but the precautions taken by the government in enrolling special constables and other preparations for defense greatly reduced the size of the gathering, which was easily dispersed. The decline of Chartism dates from that year. The repeal of the corn laws (1846)—which the Chartists had opposed as likely to benefit only the middle class—and the resulting great expansion of trade produced an improvement in economic conditions, and social unrest gradually died down.

Consult Hovell, Mark, *The Chartist Movement*, new ed., ed and completed by T. F. Tout (London 1925); Hammond, J. L. Le B., and Hammond, Barbara, *The Age of the Chartists, 1832-1854* (London 1930); Cole, G. D. H., *Chartist Portraits* (London 1941); Dodds, J. W., *Age of Paradox: A Biography of England, 1841-1851* (New York 1952).

CHARTON, shâr-tôn', Édouard (Thomas), French writer and politician: b. Sens, France, May 11, 1807; d. Versailles, Feb. 28, 1890. He began his career as a lawyer, became interested in journalism, and helped to found several magazines, including *Magasin Pittoresque* (1833), *L'Illustration* (1843), *L'Ami de la Maison* (1856), and *Le Tour du Monde* (1860). He also published a number of historical works, among them *Voyages anciens et modernes* (1854-1857) and *Histoire de France illustrée* (with Henri Léonard Bordier, 1859-1860). In 1870 he served as prefect of the Department of Seine-et-Oise, and in the follow-

ing year was elected to the Chamber of Deputies. From 1878 he served in the Senate.

CHARTAN, shâr-trân', Théobald, French painter: b. Besançon, France, Jan. 21, 1849; d. Neuilly-sur-Seine, July 17, 1907. He studied art under Alexandre Cabanel, and in 1877 was awarded the Grand Prix de Rome for *La prise de Rome par les gaulois*. Among his many religious and historical paintings are *La vision de saint François d'Assise*; *Vincent de Beauvais et Louis XI à Royaumont*; and *Cérémonie du centenaire de Victor Hugo*. His *Signing of the Peace Protocol at Washington*, depicting an episode in the Spanish-American War, was presented to the United States government by Henry C. Frick. Chartan executed the portraits of many eminent men, including Pope Leo XIII, Sadi Carnot, and of presidents William McKinley, and Theodore Roosevelt.

CHARTRES, shâr'tr', Duc DE (ROBERT PHILIPPE LOUIS EUGÈNE FERDINAND D'ORLÉANS), French nobleman: b. Paris, France, Nov. 9, 1840; d. Dec. 5, 1910. A grandson of King Louis Philippe, he went into exile with his family in 1848 and lived in Germany and England for 10 years. He then went to Italy, where he attended a military school in Turin and fought in the war against Austria. Going to the United States in 1861, he served on the staff of Gen. George B. McClellan in the following year. After the establishment of the Third Republic in 1870, he returned to France, where he served in the army under the pseudonym of Robert le Fort, rising to the rank of major by the close of the Franco-Prussian War. Subsequently he became under his own name a major in the Chasseurs d'Afrique, and in 1878 was promoted to the rank of colonel. In 1883, however, he was suspended from active service, and three years later his name was removed from the army list under a law excluding members of former reigning families from serving in the army or navy, and he went into exile once more.

CHARTRES (ancient AUTRICUM and CIVITAS CARNUTUM), city, France, capital of the Department of Eure-et-Loir, situated on the left bank of the Eure River, 48 miles southwest of Paris. It is built on the slopes of a hill rising from the river and is surrounded by tree-shaded boulevards. The streets of the lower section, which has many medieval and Renaissance houses, are narrow and winding. Besides the great Gothic cathedral (see CHARTRES CATHEDRAL), the chief points of interest are the Church of St.-Pierre, built in the 12th and 13th centuries, which has fine enamel paintings of the Twelve Apostles; the former episcopal palace, now the Musée des Beaux-Arts, which has a collection of paintings, enamels, ivories, and tapestries; and the town hall (1614), which was damaged in 1944. The city serves as a trading center for the rich agricultural and cattle-raising plain of Beauce, and has manufacturing establishments producing woolen textiles, hosiery, leather goods, agricultural machinery, and beverages.

In Roman times Chartres was the seat of the Gallic tribe of Carnutes. Later it belonged to the counts of Blois, who sold it to King Philip IV in 1286. It was occupied by the English from 1417 to 1432. During the Franco-Prussian War it was taken by German troops. The city sustained

some damage in World War II. Pop. (1946) 23,509.

CHARTRES CATHEDRAL. One of the greatest masterpieces of Gothic architecture, the Cathedral of Notre-Dame de Chartres surmounts the hill on which the city of Chartres stands. Erected on the site of a Romanesque cathedral that burned in 1020, it was in large part completed between 1194 and 1260. The triple west door—known as the Portail Royal because of its elongated statues of kings and queens—and the lower part of the façade date from the late 12th century; the upper part of the façade and the great rose window, from the early 13th century. The south spire, which is contemporary with the façade, rises to a height of 344 feet; the north spire, not completed until the 16th century, is 377 feet high. The magnificent nave, about 130 feet long, 55 feet wide, and 120 feet high, is lighted by 13th century stained glass windows, generally considered the finest medieval windows. The choir is enclosed in stone carved with statues depicting the lives of Christ and the Virgin Mary.

The cathedral is intimately connected with the history of France. Before it was completed, in 1146, St. Bernard of Clairvaux preached the Second Crusade there, and in 1594 it was the scene of the coronation of Henry IV.

Consult Vigneau, André, *La cathédrale de Chartres* (New York 1934); Adams, Henry, *Mont-Saint-Michel and Chartres*, reissue (Boston 1936); Stoddard, W. S., *The West Portals of Saint-Denis and Chartres* (Cambridge, Mass., 1952).

CHARTREUSE, shār-trüz' (Fr. shār-trüz'), a color tint extending in range from a pale yellow with a greenish cast to a pale, light green with a pronounced yellowish tinge. A slightly neutral tint—that is, having a quiet, slightly grayish tone—it has two extremes which are often identified as chartreuse yellow and chartreuse green. The color is similar to, and derives its name from, the liqueur chartreuse (q.v.).

CHARTREUSE, a liqueur with a brandy base distilled from aromatics according to a secret formula given to the Carthusian monks of La Grande Chartreuse, France, in 1607, and perfected by them in 1757. Expelled from France in 1903, the monks took their formula to Tarragona, Spain, where they continued to produce and sell the liqueur. In 1938 they were permitted to return to France.

Chartreuse is of two types: yellow, which is 86° proof; and green, 110° proof.

CHARTREUSE, La Grande, the principal monastery until 1903 of the Carthusians (q.v.), situated in the Department of Isère, France, near the village of St.-Pierre-de-Chartreuse and about 12.5 miles north of Grenoble. It was founded in 1084 by St. Bruno of Cologne (q.v.), but the present buildings date from 1676. From the mother house the order spread to other European countries. During the French Revolution the monastery was confiscated, and the monks were secularized or banished. In 1816, the Carthusians were permitted to reoccupy the buildings as tenants of the government, which charged them a nominal rent. Under the Associations Law of 1901, however, the monks were once more dispossessed, and in 1903 they moved to Tarragona, Spain, taking with them the formula for their celebrated liqueur, chartreuse (q.v.). In 1938 the

Carthusians were permitted once more to occupy La Grande Chartreuse.

CHARTREUSE DE PARME, La (THE CHARTERHOUSE OF PARMA), published in 1839, is considered the best of the novels of Stendhal (Henri Beyle). In time it belongs to the romantic movement, and it has highly romantic passages, but there are others which seem to foreshadow naturalism. The story opens in 1796 and passes rapidly to the decade following the Battle of Waterloo. The scene is laid chiefly in Milan and Parma; the plot, ingenious but too involved, deals with the intrigues of a petty Italian court; and the interest, for both author and reader, lies almost entirely in characterization. Fabrice del Dongo, the hero, his military career closed by the fall of Napoleon, turns his ambition toward the church, and after adventures that show him, in Charles Augustin Sainte-Beuve's phrase, "like an animal given over to his appetites or like a wanton child who follows his caprices," dies an archbishop in a Carthusian monastery. The heroine, Duchess Sanseverina, beautiful, witty, and passionate, murders, marries, and forgets her marriage vows in Fabrice's behalf, resembling some of the female figures of the Italian Renaissance. Count Mosca is a diplomatic courtier, ingeniously unscrupulous in reconciling the duties of his station with his desires. Palla, a political outlaw and highwayman, the philandering agent of the duchess' designs, is an interesting age fellow of Victor Hugo's Hernani. All four characters illustrate as many phases of Stendhal's conception of the unreasoning fatality of love.

CHARTULARY, kār'tū-lēr-i, a collection or register of charters. In the Middle Ages, when any ecclesiastical or secular body came to possess a considerable number of charters, it was customary for safety and convenience to have them classified and copied into a book or roll, called a chartulary. Although they have been traced in France as far back as the 10th century, it was not until the 12th and 13th centuries that chartularies became common. They were kept not only by all kinds of religious and civil corporations, but also by private families. Copies of valuable historical documents, whose originals have been lost, have been found in chartularies.

CHARYBDIS. See SCYLLA AND CHARYBDIS.

CHASE, Frederic Henry, English prelate: b. London, England; Feb. 21, 1853; d. Bexhill, Sept. 23, 1925. He was educated at King's College School, London, and at Christ's College, Cambridge, from which he was graduated in 1876. In the same year he was ordained deacon, and in 1877 priest, of the Church of England. From 1876 to 1879 he served as curate of Sherborne, and from 1879 to 1884 as curate of St. Michael's, Cambridge. He was lecturer in theology at Pembroke College (1881-1890) and at Christ's College (1893-1901); principal of the Cambridge Clergy Training School (1887-1901); vice-chancellor of Cambridge (1902-1904); and Norrisian professor of divinity (1901-1905) and president (1901-1906) of Queen's College. Appointed bishop of Ely in 1905, he served in this office until he retired in 1924. Chase contributed much to the revision of the Book of Common Prayer. His published works include *Chrysostom* (1887);

The Lord's Prayer in the Early Church (1891); *Old Syriac Element in Codex Bezae* (1895); *Syro-Latin Text of the Gospels* (1897); *The Credibility of the Book of the Acts* (1902); *Confirmation in the Apostolic Age* (1909); *Belief and Creed* (1918); and *The Creed and the New Testament* (1920).

CHASE, Frederick Lincoln, American astronomer: b. Boulder, Colo., June 28, 1865; d. near there, Nov. 8, 1933. He received his B.A. degree from the University of Colorado in 1886, and his Ph.D. from Yale University in 1891. In 1890 he joined the staff of the Yale Observatory, and in the following year was appointed assistant astronomer, a position he held until 1911. From 1910 to 1913 he served as acting director of the observatory. His published works include "Heliumeter Triangulation of the Victoria Comparison Stars," in *Annals of the Cape Observatory* (1897); and the following papers in *Transactions of Yale University Observatory*: "Triangulation of the Principal Stars of the Cluster in Coma Berenices" (vol. 1, part 5, 1896); "Parallax Investigations on 163 Stars, Mainly of Large Proper Motion" (vol. 2, part 1, 1906); "Parallax Investigations on 35 Selected Stars" (vol. 2, part 2, 1910); "Catalogue of Yale Parallax Results" (vol. 2, part 4, 1912); and "Parallax of 41 Southern Stars" (vol. 2, part 3, 1912).

CHASE, George, American law professor: b. Portland, Me., Dec. 29, 1849; d. New York, N. Y., Jan. 8, 1924. He was graduated from Yale University in 1870 and from Columbia Law School in 1873. In the same year he was admitted to the New York bar, but never practiced. From 1873 to 1878 he was instructor and then assistant professor of municipal law, and from 1878 to 1891 professor of criminal law, torts, and procedure, at Columbia Law School. Disapproving the adoption of the case system of teaching law, he resigned from the Columbia faculty in 1891 and became dean of the New York Law School, which had been chartered through his efforts, and remained in this post until his death. His published works include *The American Student's Blackstone* (1876-1877); *Leading Cases Upon the Law of Torts* (1892); *Leading Cases Upon the Law of Wills* (1892); and *The Code of Civil Procedure of the State of New York as Amended* (1909-1920).

CHASE, Harry Woodburn, American educator: b. Groveland, Mass., April 11, 1883. He received his B.A. (1904) and M.A. (1908) degrees from Dartmouth College, and his Ph.D. (1910) from Clark University. In 1909-1910 he directed a clinic for subnormal children at Clark University, and then became professor of psychology at the University of North Carolina, a post he retained until 1918, when he was appointed acting dean of the college of liberal arts. From 1919 to 1930 he served as president of the university, and from 1930 to 1933 as president of the University of Illinois. Appointed chancellor of New York University in 1933, he remained in this position until his retirement in 1951. During his tenure as chancellor notable advances were made in many fields, and particularly in law and medicine.

CHASE, Mary Coyle, American playwright: b. Denver, Colo., Feb. 25, 1907. After attending

the University of Denver (1921-1923) and the University of Colorado (1923-1924), Mary Coyle became a reporter. In 1928 she married Robert Lamont Chase, by whom she had three children. From 1928 to 1931 she was a reporter for the *Rocky Mountain News* in Denver, and from 1932 to 1936 a free-lance correspondent of the International News Service and the United Press. Soon thereafter she began to write plays, including *Now You've Done It* (1937) and *Too Much Business* (1938). Her first success came in 1944, with the New York production of *Harvey*, for which she received the Pulitzer Prize in 1945. Her gift for fantasy was exhibited again in 1952, with the production of *Mrs. McThing*. Later that year a comedy, *Bernardine*, was also presented in New York.

CHASE, Mary Ellen, American educator and writer: b. Blue Hill, Me., Feb. 24, 1887. She received her B.A. degree from the University of Maine in 1909, and her M.A. (1918) and Ph.D. (1922) degrees from the University of Minnesota. After serving as instructor (1918-1922) and assistant professor (1922-1926) of English at the University of Minnesota, she joined the faculty of Smith College as associate professor of English literature, attaining full professorship in 1929. In addition to many essays and books on writing, her published works include *Uplands* (1927); *A Goodly Heritage* (autobiographical novel, 1932); *Mary Peters* (her best-known novel, 1934); *Silas Crockett* (1935); *This England* (1936); *Dawn in Lyonesse* (1938); *A Goodly Fellowship* (1939); *Windswept* (1941); *The Bible and the Common Reader* (1944); *Jonathan Fisher* (biography, 1948); *The Plum Tree* (1949); *Abby Aldrich Rockefeller* (biography, 1950); and *Readings from the Bible* (1952); *Recipe for a Magic Childhood* (1952).

CHASE, Philander, American Episcopal clergyman: b. Cornish, N. H., Dec. 14, 1775; d. Jubilee College, Ill., Sept. 20, 1852. He was graduated from Dartmouth College in 1796, and was ordained deacon (1798) and priest (1799) of the Protestant Episcopal Church. After holding several missionary charges in northern New York, he moved to New Orleans in 1805 and then to Hartford, Conn., in 1811. In 1817 he went to Ohio, where he organized a number of parishes; two years later he was consecrated first bishop of Ohio. He served as president of Cincinnati College in 1821-1822, and then made plans for the establishment of a theological seminary. To raise funds for it, he went to England, where, through the influence of the 1st Baron Gambier and the 2d Baron Kenyon, he obtained \$30,000, with which, in 1824, he founded Kenyon College at Gambier, Ohio. Chase served as president of the college until 1831, when he resigned this office as well as his bishopric. In 1835 he was elected bishop of Illinois. Visiting England once more, he raised \$10,000, with which he founded (1839) Jubilee College, Peoria County, Ill. (The main building of the college is preserved in Jubilee College State Park.) In 1843, on the death of Bishop Alexander Viets Griswold (q.v.), Chase became presiding bishop of the church. His published works include *Star in the West or Kenyon College* (1828); *Defence of Kenyon College* (1831); *A Plea for Jubilee* (1835); and *Reminiscences of Bishop Chase, an Autobiography* (2 vols., 1848).

CHASE, Pliny Earle, American scientist: b. Worcester, Mass., Aug. 18, 1820; d. Haverford, Pa., Dec. 17, 1886. He was graduated from Harvard College in 1839 and became a teacher, serving as principal of district schools in Leicester and Worcester, Mass., until 1841, when he went to Philadelphia. After teaching there for seven years, he was engaged in the stove and foundry business until 1861, when he resumed his profession. Meanwhile he employed his leisure in scientific studies, and in 1864 received the Magellanic Medal of the American Philosophical Society for his paper, "Numerical Relations Between Gravity and Magnetism." The results of further research in mathematics and physics were published subsequently in over 120 articles in *Proceedings of the American Philosophical Society*; he also wrote *Elements of Meteorology for Schools and Households* (1884). In 1871 he became professor of natural sciences, and in 1875 professor of philosophy, at Haverford College.

CHASE, Salmon Portland, American lawyer and statesman: b. Cornish, N. H., Jan. 13, 1808; d. New York, N. Y., May 7, 1873. His father, Ithamar Chase, died when he was nine years old, and soon thereafter he was placed under the care of his uncle, Philander Chase (q.v.), Episcopal bishop of Ohio, and attended the bishop's school at Worthington, near Columbus. He entered Cincinnati College, of which his uncle was president, in 1821, but remained there less than a year before he returned to New Hampshire. After some preparatory study he entered Dartmouth College as a junior, being graduated in 1826. He then went to Washington, D.C., where he conducted a boys' school for three years. In Washington he made the acquaintance of William Wirt (q.v.), under whose nominal supervision he studied law. Admitted to the bar in 1829, he began to practice in Cincinnati in the following year and soon became known as one of the best lawyers in the city. In 1832 he formed the project of compiling a collection of the laws of Ohio with notes and references. Published as *Statutes of Ohio* (3 vols., 1833-1835), it became the standard edition and gave Chase a solid reputation throughout the Middle West. Early in his career he became identified with the antislavery movement, but he indignantly disavowed any sympathy with the sentiments of William Lloyd Garrison (q.v.), declaring that he was not one of those "abolitionists or antislavery men who regarded the Constitution as at war with moral obligations and the supreme law." He states in his diary that he differed with Garrison and others "as to the means by which the slave power could be best overthrown and slavery most safely and fitly abolished under our American Constitution." He was a frequent speaker at antislavery meetings and conventions in Ohio and other states, but he was neither an orator nor a good stump speaker. His forte was the preparation of formal addresses and platforms, in which he had time and space to marshal his facts and thoughts, and he was often called on to undertake such tasks for the Liberty and Free-Soil parties. While these abilities made Chase a valuable ally of the Ohio antislavery men, he became their leader chiefly through his pronouncements against slavery and his legal services in connection with fugitive slave cases. He became known as the "attorney general for runaway Negroes," but was defeated in

every case in which he appeared for the defense. Some of his arguments were against historical facts, as when he denied that Congress had power to establish slavery anywhere by any process. He admitted that laws had been framed to support slavery in the District of Columbia, in the territories, and, insofar as fugitive slaves were concerned, in the free states, but he held that Congress had no constitutional power to enact such laws. In March 1837, he acted as counsel for Matilda, an alleged fugitive slave, and for James G. Birney, accused of harboring her. Chase based his argument on the fact that Matilda had been brought into Ohio by her master and had escaped, and so was a free person and could not be "a person held to service or labor in one State, under the laws thereof, escaping into another." The case was decided against Chase, and Matilda was remanded into slavery, but Birney appealed and the state supreme court reversed the decision.

In 1840, Chase, a former Whig, joined the new Liberty Party. Within a year he was practically the leader of the party in Ohio, and for eight years he organized conventions, prepared party addresses, and bolstered the antislavery press. He presided over the convention of its successor, the Free-Soil Party, in Buffalo in 1848. In 1849, through a combination of Democrats and Free-Soilers in the state legislature, he was elected to the United States Senate. There he continued his opposition to slavery during the period of the Compromise of 1850, and was particularly outspoken in condemning the position of Henry Clay. He usually acted with the Democrats, since he claimed to have been elected as a Democrat, and thereby lost much of the confidence of the Free-Soilers. He gradually became estranged from the Democrats, however, and the nomination of Franklin Pierce for the presidency in 1852 on a platform pledged to support the Compromise of 1850 forced Chase to withdraw entirely from the Democratic Party and rejoin his old Free-Soil allies. In 1854 he became a leader of the opposition in the Senate to the Kansas-Nebraska Bill, issuing his celebrated "Appeal of the Independent Democrats in Congress to the People of the United States." With the dissolution of the Whig Party, Chase did much to further the formation by northern Whigs and independent Democrats of the Republican Party, and in 1855 the new party (then known as an anti-Nebraska party) nominated him for the governorship of Ohio. Elected after a close contest, he introduced a number of needed reforms in state administration and continued his efforts on behalf of the Negroes. In 1856 he was an unsuccessful candidate for the Republican presidential nomination, and in the following year was re-elected governor. In February 1860, he was re-elected to the Senate for the term beginning in 1861. Again in 1860 he endeavored to obtain the presidential nomination, but received only 49 votes on the first ballot, and his supporters later threw their votes to Abraham Lincoln. In January 1861, Lincoln, then president-elect, invited Chase to become secretary of the treasury. Relinquishing the senatorship, he accepted and took office in March.

Hardly had Chase become secretary when, in April 1861, the Civil War began. He rehabilitated the Treasury; suggested and secured the enactment of new taxes and property confiscation acts; borrowed money; provided the legal-tender

paper currency authorized by Congress; proposed a national banking system and saw it put into operation (1863); and in general administered his department and the financial affairs of the country in a creditable manner. Despite his heavy duties, however, he never lost sight of the slavery question. He opposed Lincoln's colonization project, but warmly supported the Emancipation Proclamation. Chase differed with the president in many of his political views, and he felt aggrieved when Lincoln disregarded his advice on military affairs. He corresponded with military officers, and often expressed distrust of the president's conduct of affairs. He had hoped to obtain ascendancy over Lincoln, and when he learned that Lincoln completely controlled the situation and was determined to abide by his own policies, he resigned, on Dec. 20, 1862, stating that he expected his opinions and those of his colleagues in the cabinet to carry more weight with the president: "There are certain heads of departments, but no real Cabinet." Lincoln refused to accept the resignation, but on March 3, 1863, Chase prepared another resignation because the president had refused to nominate a revenue collector selected by the secretary. Again, on May 11, 1863, Chase became disgruntled because Lincoln had removed an official whom the president considered unfit for his post, but the proffered resignation was refused. The minor differences between Lincoln and Chase were accentuated by their rivalry for the presidential nomination in 1864. The issuance in February 1864 of the Pomeroy Circular, criticizing Lincoln, rendered Chase's nomination impossible and placed him in a delicate relationship with the president, and on February 22, he again offered to resign and again was requested to remain. Finally, in June 1864, another dispute arose over patronage and, although it was settled peaceably, Chase decided once more to resign, on June 29. On the following day, Lincoln unexpectedly accepted the resignation, appointing William P. Fessenden as Chase's successor.

Before his retirement from the cabinet Chase had signified a desire to be chief justice of the United States, and on Dec. 6, 1864, Lincoln nominated him to fill the post made vacant by the death of Roger B. Taney. Chase took little part in President Andrew Johnson's dispute with Congress regarding reconstruction, but he privately opposed the readmission of any seceded state until it had granted suffrage to Negroes. He drafted the 14th Amendment, and later used it in his dissent from the court's decision in the *Slaughterhouse Cases* (q.v.). He considered the president's military governments abnormal, and even after Johnson's proclamation declaring the war at an end (April 2, 1866) he steadfastly refused to hold court in Virginia and North Carolina (which were included in his circuit) "until all possibility of claim that the judicial is subordinate to the military power is removed by express declaration from the President." In June 1867, however, he assumed his functions in Raleigh. Chase dissented from the court's decision in the *Milligan* (see *MILLIGAN, EX PARTE*), *Cummings*, and *Garland* cases. He refused at first to sit in the trial of Jefferson Davis, and was relieved when the case was terminated by the amnesty proclamation of Dec. 25, 1868. Though considering the trial impolitic and unjust, Chase presided with calmness and good judgment over the impeachment of President

Johnson. Meanwhile, he had permitted his name to be brought before the Republicans as a presidential candidate, but soon became convinced that he could not secure the nomination and a few weeks later endeavored to become the Democratic nominee. Failing once more in his persistent ambition, he continued his work on the bench. Among the important decisions he wrote was that in the case of *Texas v. White*, in which he expounded the nature of government as "an indestructible Union, composed of indestructible States," reversing his previous theory of state suicide and, as he did also in the case of *White v. Hart*, approving the method of reconstruction that had been adopted. He wrote the court's decision in the case of *Hepburn v. Griswold*, reviewing judicially and construing the statutes which as secretary of the treasury he himself had set in motion only a few years before. The court decided that the Legal Tender Act of 1862 was unconstitutional insofar as it compelled the acceptance of legal-tender paper currency in payment of debts contracted before the statute had been enacted. By subsequent decisions in the Legal-Tender Cases (q.v.), however, Chase was reversed, the court holding the act constitutional.

In August 1870, Chase had a paralytic stroke, but he gradually recovered and, though absent from the court during the term of 1870-1871, sat during the terms of 1871-1872 and 1872-1873, preparing numerous opinions. He was well enough in 1872 to aspire to the presidential nomination once more, but in 1873 his health failed rapidly and he lived only a day after a second stroke.

Consult Hart, A. B., *Salmon Portland Chase* (Boston 1899); Smith, D. V., *Chase and Civil War Politics* (Columbus 1931); Hendrick, B. J., *Lincoln's War Cabinet* (Boston 1946); Donald, David, ed., *Inside Lincoln's Cabinet: The Civil War Diaries of Salmon P. Chase* (New York 1954).

CHASE, Samuel, American jurist and Revolutionary leader: b. Somerset County, Md., April 17, 1741; d. June 19, 1811. He was educated by his father, the Rev. Thomas Clark, who instructed him in the classics, and from 1759 to 1761 studied law at Annapolis, being admitted to the bar at the age of 20. As a member of the Maryland General Assembly (1764-1784), he distinguished himself by his opposition to the royal governor. He took the lead in denouncing and resisting the Stamp Act, and in 1774 became a member of the Maryland Committee of Correspondence and was chosen as a delegate to the 1st Continental Congress. He served in subsequent congresses until 1778, and again in 1784 and 1785. That of 1776 sent him with Benjamin Franklin and Charles Carroll of Carrollton on a mission to Canada. Chase signed the Declaration of Independence without hesitation, and was active on numerous committees until 1778, when his attempt to obtain a corner on flour through information he had received as a member of Congress was attacked by Alexander Hamilton and resulted in Chase's political eclipse until 1783. In that year the governor of Maryland sent him to London to recover Maryland's stock in the Bank of England, but he accomplished little and the matter was not settled for many years. In 1788, Chase was appointed chief judge of the criminal court, and in 1791 chief judge of the general court. Although he opposed the adoption of the Constitution, he later became a Fed-

eralist. In 1796, George Washington appointed him to the Supreme Court, where he delivered a number of notable opinions, including that in the case of *Ware v. Hylton*, in which he asserted the supremacy of national treaties over state laws. In 1804, however, his conduct as a circuit judge in 1800 and 1803 resulted in his impeachment by the House of Representatives. In his trial before the Senate in the following year he defended himself ably, and was acquitted.

CHASE, Stuart, American writer: b. Somersworth, N. H., March 8, 1888. He was educated at the Massachusetts Institute of Technology and at Harvard University, from which he was graduated in 1910. He then practiced as a certified public accountant in Boston until 1917, when he was employed by the Federal Trade Commission as an investigator. In 1922 he became associated with the Labor Bureau, Inc., a connection he maintained until 1939. His published works, in addition to many articles, include *The Tragedy of Waste* (1925); *Men and Machines* (1929); *A New Deal* (1932); *The Economy of Abundance* (1934); *Rich Land, Poor Land* (1936); *The Tyranny of Words* (1938); *The New Western Front* (1939); *Idle Money, Idle Men* (1940); *Men at Work* (with his wife, Marian Tyler, 1945); *Tomorrow's Trade* (1945); *The Proper Study of Mankind* (1948); *Roads to Agreement* (with Marian Tyler, 1951); and *Power of Words* (1954).

CHASE, William Merritt, American painter: b. Williamsburg, Ind., Nov. 1, 1849; d. New York, N. Y., Oct. 25, 1916. He studied art at the National Academy of Design in New York from 1869 to 1871. In the following year he went to Europe and continued his studies at Munich and Venice for five years. In 1878 he opened a studio in New York, where he spent most of his time thereafter, teaching at the Art Students' League and exhibiting at the National Academy, of which he became a member in 1890. Among his paintings, which include portraits, still-life subjects, and landscapes, are a portrait of James Whistler, *Carmencita*, and *The Lady in Black*, all in the Metropolitan Museum of Art, New York; *Ready for the Ride* (1878); *American Fish* (1905); *Portrait of an Artist* (1906); *Studio Interior* (1911); *The Orangery* (1911); and *Portrait of Mrs. H.* (1912).

CHASE CITY, town, Virginia, situated in Mecklenburg County, 28 miles east-northeast of South Boston. It has freight service via the Southern Railway. There are tobacco warehouses and establishments manufacturing wood products, clothing, and shoes, and processing food. The town was incorporated in 1873. Pop. (1950) 2,519.

CHASE NATIONAL BANK OF THE CITY OF NEW YORK, The. One of the largest and most important commercial banks in the United States, the Chase had deposits of \$5,174,415,072 and total assets of \$5,678,726,512 as of June 30, 1954.

The Chase National Bank was organized by John Thompson on Sept. 12, 1877, and opened for business at 177 Broadway, New York. The original capital stock of the bank, \$300,000, was owned by five of its organizers. On June 30, 1954, the capital funds of the bank amounted to

\$390,299,391, consisting of capital of \$111,000,000, surplus of \$219,000,000, and undivided profits of \$60,299,391. The 7,400,000 shares of stock were owned by about 78,000 shareholders.

Col. Samuel C. Thompson, son of the founder, was the first president. On his death in 1884 he was succeeded by his father. Between 1886 and 1911 the bank was headed consecutively by two former United States comptrollers of the currency, Henry W. Cannon and A. Barton Hepburn. Albert H. Wiggin served as president from 1911 to 1918, and as chairman of the board of directors from 1918 to 1930. Winthrop W. Aldrich, former president of the Equitable Trust Company, became president in 1930 and chairman of the board in 1934. He was succeeded in the presidency by H. Donald Campbell, who retired in 1946, at which time Arthur W. McCain was elected president. In 1949, Percy J. Ebbott was elected president. Winthrop W. Aldrich retired as chairman of the board in 1953, and was succeeded by John J. McCloy.

In 1921 the Chase enlarged its resources for the first time by consolidation with another bank. Merging with the Metropolitan National Bank, it acquired the nucleus of its branch system by taking over seven metropolitan branches in New York. In 1925 the first of its foreign branches were obtained: Havana, Cristobal, and Panama. Thereafter the following banks were merged with the Chase: Mechanics and Metals National Bank (1926); Mutual Bank (1927); Garfield National Bank and National Park Bank (1929); Equitable Trust Company and Interstate Trust Company (1930); and American Express Bank and Trust Company (1931). The Chase in 1953 had 28 branches in New York and 17 branches abroad: 2 in London; 1 each in Paris and Frankfurt am Main; 2 in Japan; 4 in Cuba; 2 in Puerto Rico; and 1 each in Panama, Colón, David, Cristobal, and Balboa. Safe deposit vaults are maintained in New York offices and in Paris. The Chase National Executors and Trustees Corporation, Ltd., London, is an affiliate. Offices of representatives are located in Mexico City, Buenos Aires, Rome, Beirut, and Bombay.

The Chase National Bank is one of the principal New York depositaries for banks of the United States and other countries. It serves as New York correspondent for some 3,800 United States banks, or more than half the nation's banks which utilize New York correspondent facilities. Every type of banking service is offered by the Chase through its commercial, foreign, and trust departments. Included in the last named are personal, corporate, agency, and pension trust services. The Chase also provides such popular services for individuals as installment loans, savings accounts in its compound interest department, and no-balance checking accounts.

The Chase had an outstanding record in assisting the United States government to raise funds through the sale of war loan securities during World War II. More than \$28.8 billion in war and victory bonds were sold by the bank and members of its staff—a sum representing 5.3 per cent of all the bonds sold during eight nationwide campaigns.

CRAWFORD WHEELER, Vice President, The Chase National Bank of the City of New York.

CHASING, the art of indenting designs on metals. Figures on metal are often produced in

relief by being punched out from behind and sculptured or finished in front with small chisels and gravers. It is the latter process that is properly called chasing, and the same term is applied to designs produced by hand tools on more or less flat surfaces. The process is a very old one and is seen on ancient Egyptian, Assyrian, and Greek works of art.

CHASKA, chās'ká, city, Minnesota, seat of Carver County, situated at an altitude of 725 feet, on the Minnesota River, 20 miles southwest of Minneapolis. It is served by the Chicago, Milwaukee, St. Paul and Pacific and the Minneapolis & St. Louis railroads. The city serves as a center for the surrounding farming region and has plants producing beet sugar, dairy products, canned vegetables, and bricks. There are three prehistoric Indian mounds in the city park. First settled in 1853, Chaska was incorporated as a village in 1871 and as a city in 1891. Pop. (1950) 2,008.

CHASLES, shāl, Michel, French mathematician: b. Épernon, France, Nov. 15, 1793; d. Paris, Dec. 18, 1880. While a student at the École Polytechnique in 1814, he took part in the defense of Paris. After his graduation in the following year he retired to Chartres, where he devoted himself to mathematical studies. In 1829 he addressed to the Brussels Academy a memoir on two general principles of geometry, duality and homography. The introduction to this memoir was expanded into *Aperçu historique sur l'origine et le développement des méthodes en géométrie* (1837). In 1841, Chasles was appointed professor of geodesy and applied mechanics at the École Polytechnique, and in 1846 professor of advanced geometry at the Sorbonne. In 1851 he became a member of the Académie des Sciences. Chasles contributed much to projective geometry. His published works include *Traité de géométrie supérieure* (1852); *Trois livres de géométrie d'Euclide* (1863); *Traité des sections coniques* (1865); and *Rapport sur les progrès de la géométrie* (1874).

CHASLES, (Victor Euphémon) Philarète, French scholar and writer: b. Mainvilliers, France, Oct. 8, 1798; d. Venice, Italy, July 18, 1873. The son of a Jacobin, Pierre Jacques Michel Chasles, he was educated according to the principles of Jean Jacques Rousseau's *Émile*. From 1817 to 1823 he lived in England and later traveled widely in other European countries, whose literatures he studied and interpreted for French readers. In 1837 he was appointed curator of the Bibliothèque Mazarine, and in 1841 professor of Continental languages and literatures at the Collège de France. His published works include *Tableau de la marche et du progrès de la langue et de la littérature françaises depuis le commencement du XVI^e siècle jusqu'en 1610* (1828); *Oliver Cromwell* (1847); *L'antiquité* (1847); *Le seizième siècle en France* (1848); *Galileo Galilei* (1862); *Esquisses* (1846-1864); *Les voyages d'un critique à travers la vie et le livre* (1866-1868); *L'Artin, sa vie et ses écrits* (1873); and *Mémoires* (1877).

CHASSAIGNAC, shā-sē-nyák', Pierre Marie Édouard, French surgeon: b. Nantes, France, 1804; d. Versailles, Aug. 26, 1879. He studied medicine in Nantes and went to Paris,

where he became a professor at the university and a member of the Académie de Médecine. His contributions to surgery include the invention of the instrument known as the linear écraseur and the introduction (1859) of drainage by rubber tubes. He was one of the first to dress wounds by complete occlusion. Chassaignac's tubercle is named for him. His published works include *Études d'anatomie et de pathologie chirurgicale* (2 vols., 1851); *Traité de l'écrasement linéaire* (1856); *Traité pratique de la suppuration et du drainage chirurgical* (2 vols., 1859); and *Traité clinique et pratique des opérations chirurgicales* (2 vols., 1861-1862).

CHASSE, shā-sā', BARON David Hendrik, Dutch general: b. Tiel, Netherlands, March 18, 1765; d. Breda, May 2, 1849. Trained as a soldier from his early youth, he entered French service in 1787, and by 1793 had risen to the rank of lieutenant colonel. He fought in the Netherlands under Gen. Charles Pichegru in 1795, and subsequently distinguished himself with French armies in Germany and, from 1808 to 1813, in Spain. Because of his fondness for bayonet charges, Napoleon nicknamed him General Baionette. In 1809 he was made a baron by Louis Bonaparte, who was then king of Holland. Chassé fought as a general of division in the defense of France in 1814, but after the abdication of Napoleon in April he joined the Dutch Army. As lieutenant general of the Dutch forces at Waterloo in 1815, he did good service against his former comrades, the French. He defended the citadel of Antwerp against the Belgians in 1830, and against the French in 1832. On the latter occasion he was forced to surrender after a three weeks' siege. Made a prisoner of war by the French, he was released in May 1833 and retired to private life.

CHASSELOUP-LAUBAT, shās-lōō' lō-bā', François de, French soldier and military engineer: b. St.-Sernin, Charente-Maritime, France, Aug. 18, 1754; d. Paris, Oct. 10, 1833. He entered the army in 1774 and by 1791 had risen to the rank of captain. In 1797 he distinguished himself at the siege of Mantua, and two years later was made chief of engineers in Italy. He was in charge of fortifications at the siege of Danzig in 1807, and retired from the army in 1812. He was made a peer by Louis XVIII.

His son, JUSTIN PROSPER CHASSELOUP-LAUBAT (b. Alessandria, Italy, March 29, 1805; d. Versailles, France, March 29, 1873), served as minister of marine in 1851 and from 1859 to 1867. He was president of the Conseil d'État in 1869 and a member of the National Assembly in 1871.

CHASSEPOT, shās-pō', a breech-loading rifle named for its inventor, Antoine Alphonse Chassepot (1833-1905), which was adopted for use in the French Army in 1866, after the value of the Prussian needle gun had been shown in the Austro-Prussian War. Considerably lighter than the needle gun, it proved a much better weapon in the Franco-Prussian War, but was replaced by another type in 1874 and was little used thereafter. It was a bolt-action gun with an effective range of 1,500 paces, but its lightness (it weighed 9 pounds, 5 ounces) and its large charge produced a great recoil, and the barrel heated so that the weapon could hardly be handled.

CHASSERIAU, shā-sā-ryō', **Théodore**, French painter: b. Samaná, Dominican Republic, Sept. 20, 1819; d. Paris, France, Oct. 8, 1856. He was greatly influenced by Jean Auguste Dominique Ingres, under whom he studied in Rome, but later became primarily a colorist. In addition to murals in the Église St.-Merri (1843), the Église St.-Roch (1854), and those he painted for the Cours des Comptes in the Palais d'Orsay (fragments which survived the burning of the palace in 1871 are preserved in the Louvre), Chassériau's works include *Cain maudit* (1836); *Retour de l'enfant prodigue* (1836); *Suzanne au bain* (1839); *Vénus Anadyomène* (1839); *Le Christ au jardin des oliviers* (1839); *Andromède attachée au rocher par les Néréides* (1841); *Esther se parant pour être présentée à Assuérus* (1842); *Captives troyennes* (1842); and *Portrait équestre d'Ali-ben-Hamet, calife de Constantine*.

CHASSEUR, shā-sūr', a word of French origin, meaning "hunter," applied to a member of a body of special light infantry or cavalry troops in France and, formerly, in other European countries. Chasseurs were first organized in 1743 and were widely used in the late 18th and 19th centuries and, to some extent, in World War I, but they declined in importance with the introduction of mechanized warfare. In the post-World War II French Army there were only a few battalions of Chasseurs Alpins (light mountain troops) and a single squadron of Chasseurs d'Afrique.

CHASTELARD, shā-tlār', **Pierre de Boscobel de**, French poet: b. Dauphiné, France, 1540; d. Edinburgh, Scotland, 1563. A grandson of the seigneur de Bayard (q.v.), he fell in love with Mary Stuart at the court of Francis II, to whom she was then married, and expressed his admiration for her in innumerable poems. When, in 1561, following the death of her husband, she returned to Scotland, Chastelard was one of her escort. Obligated to return to France after this duty was performed, he went to Scotland once more in 1562. Mary gave him a gracious welcome, and he accompanied the court to Burntisland Castle. There he continued to press his suit in an increasingly indiscreet manner. Finally, in 1563, he was brought to trial at St. Andrews and hanged.

CHASTELARD, a tragedy published in 1865 by Algernon Charles Swinburne (q.v.). Written in 1862 and dedicated to Victor Hugo, it was inspired by the tragic death of Pierre de Boscobel de Chastelard (q.v.). In the play, Mary Beaton, who loves Chastelard herself, admits him to Mary Stuart's chamber, where he convinces the queen of his love for her. She, not wishing the love known, orders his death. Although the play has many beautiful lines, it lacks action and is meant to be read rather than performed on the stage.

CHASTELLAIN or **CHASTELAIN**, shā-tlān', **Georges**, Flemish chronicler and poet: b. Aalst, Flanders, 1404; d. Valenciennes, France, March 20, 1475. He was a soldier in the army of Philip the Good, duke of Burgundy, until 1435, when the duke made peace with France. For 10 years Chastellain engaged in diplomatic missions in France and then returned to the service of the duke, first as a diplomat and then, from 1455, as

historiographer. His great work, the *Chronique des ducs de Bourgogne*, covers the history of the house of Burgundy from 1419 to 1474. Among his other works are *Epistre au bon duc Philippe de Bourgogne*; *Souhaits au duc Charles de Bourgogne*; *Dit de vérité*, in which he criticized Charles VII of France; and *Princes*, which contains a satire of Louis XI.

CHASTELLUX, shā-tlū', **MARQUIS François Jean de**, French soldier: b. Paris, France, 1734; d. there, Oct. 28, 1788. He entered the army in 1749, distinguishing himself as a colonel in the Seven Years' War, and served in the American Revolution as a major general under the comte de Rochambeau. His experiences in the United States, where he gained the friendship of George Washington, led him to publish several books, including *Voyages dans l'Amérique septentrionale dans les années 1780, 1781 & 1782* (2 vols., 1786); and *Discours sur les avantages et les désavantages qui résultent pour l'Europe de la découverte de l'Amérique* (1787). He became a member of the French Academy in 1775.

Consult Sincoe, J. G., *Remarks on the Travels of the Marquis de Chastellux* (New York 1931).

CHASUBLE, chāz'ū-b'l or chās'ū-b'l, the outermost vestment worn by a priest of the Roman Catholic Church in celebrating the Mass. In its original form it was circular or elliptical and resembled a poncho, with an opening for the head in the center. The modern form consists of a more or less oval front and back joined at the top, where there is an opening for the head to pass through. The garment is usually of silk embroidered and decorated with gold or silver thread and with a cross on the back. See also **COSTUME, ECCLESIASTICAL—Vestments of the Roman Church**.

CHAT, the common name of a number of birds. In the United States it is applied to two warblers, the yellow-breasted chat (*Icteria virens*), which is olive green on top and white underneath and is found in the eastern part of the country; and the long-tailed chat (*Icteria virens longicauda*), duller in color, which is found in the West from British Columbia southward to Mexico. (See also **WARBLERS**.) In Great Britain the name is applied to a number of birds of the genera *Saxicola* and *Pratincola*, including the wheatear, stonechat, and whinchat.

CHATARD, Francis Silas, American Roman Catholic prelate: b. Baltimore, Md., Dec. 13, 1834; d. Indianapolis, Ind., Sept. 7, 1918. After being graduated from Mount St. Mary's College, Emmitsburg, Md., in 1853, he studied medicine at the University of Maryland, from which he received his M.D. degree in 1856. He practiced for only two years before going to Rome to study for the priesthood at the Urban College of the Propaganda. Ordained in 1862, he was appointed vice rector of the American College in Rome in the following year, and promoted to the rectorship in 1868. Subsequently he became papa chamberlain to Pope Pius IX. In 1878 he was consecrated bishop of Vincennes, Ind. (the title of the diocese was changed from Vincennes to Indianapolis in 1898). From 1905 he was assisted by a bishop coadjutor, Joseph Chartrand. During Bishop Chatard's tenure a new cathedral, a hospital, and a number of schools were built in

Indianapolis. He was much interested in education, and he translated a number of works from the French.

CHATEAU. See CASTLES AND CHATEAUX.

CHATEAU-THIERRY, shā-tō' tyē-rē', town, France, situated in the Department of Aisne, on the right bank of the Marne River, 37 miles south-southwest of Laon. It occupies the side of a hill, whose summit is crowned by the ruins of the old castle of Thierry, said to have been built by Charles Martel. The house in which Jean de La Fontaine was born in 1621 is preserved as a museum. The town has an active trade in champagne wines and manufactures musical instruments, agricultural tools, and woolen yarn. Stone is quarried nearby.

Château-Thierry has an ancient military history. It was captured by the English in 1421, and by Charles V in 1544. Several battles were fought in the town in 1814, and in 1870 it was occupied by the Germans. In 1918, at nearby Belleau Wood, American troops won their first successes against the Germans (see WAR, EUROPEAN—*Military Operations on the Western Front*), and there is an American military cemetery there. The town was badly damaged during the war, and it sustained further damage in World War II. Pop. (1946) 7,283.

CHATEAUBRIAND, shā-tō-brē-ān', VICOMTE (François) René de, French writer and statesman: b. St.-Malo, France, Sept. 4, 1768; d. Paris, July 4, 1848. A member of an ancient aristocratic family, he entered the army in 1786. At the outbreak of the French Revolution he went to Paris to witness the great events taking place there. On the pretext of exploring to discover the Northwest Passage, he went to the United States in April 1791. There he confined his travels mainly to the eastern part of the country and met George Washington in Philadelphia. Out of his American experiences he later (1826) published *Les Natchez* (see NATCHEZ, LES).

Returning to France in January 1792, he married Céleste Buisson de Lavigne. Soon thereafter he joined other émigrés in the Prussian Army on the Rhine. Wounded at Thionville in September 1792, he went to London, where, impoverished and in poor health, he led at first a miserable existence. Eventually he was able to earn a living by giving French lessons and making translations for the booksellers. In 1797 he published *Essai historique, politique et moral sur les révolutions anciennes et modernes, considérées dans leurs rapports avec la Révolution française*, which had little success in England and attracted no notice in France. The essay is pervaded by a strong skepticism toward religion, but Chateaubriand's views on this subject soon underwent a sudden and important change. The death of his mother in prison, and the account of her last moments sent him by his sister, who had died herself by the time her letter reached her brother, made a lasting impression on Chateaubriand. Thereafter he became a firm believer in Christianity.

In 1800 he ventured to return to France. Encouraged by the success of an essay on literature which he had contributed to the *Mercure de France*, he published in 1801 his *Atala* (q.v.). With another romance, *René*, it was introduced as an episode into his celebrated work, *Génie du*

Christianisme, which appeared in the following year. This work may be said to have caused a religious revival, and it inaugurated a new period in the social history of France. Chateaubriand's object was to demonstrate the superiority of Christianity over all other religions from a poetic and artistic, as well as a moral, point of view. Though more brilliant than profound, the *Génie du Christianisme* is unsurpassed for beauty of language and description and for the eloquence of its impassioned appeal. Its main charm lies in its imagery, which is drawn from nature, and especially from nature as exemplified in the scenery of the New World. In this respect, Chateaubriand may be said to have revived in French literature the description of nature. (See also GENIUS OF CHRISTIANITY, THE.)

Chateaubriand's work attracted the attention and admiration of Napoleon Bonaparte, and in 1803 he was appointed French minister to the Republic of Valais, but he resigned in 1804 after the execution of the duc d'Enghien. Going into exile once more, he traveled extensively in Greece, Turkey, Palestine, North Africa, and Spain. In order to give tangible form to the theories which he had propounded in the *Génie du Christianisme*, he began to write *Les Martyrs*, his travels in the Middle East enabling him to describe accurately the scenes amid which part of the epic is laid. Published in 1809, it is considered by some critics to be his best work. Some of the descriptions, such as those of the ancient forests of Gaul, the assemblies of Christians in the catacombs, and the picture of Rome under the emperors, are extremely beautiful. His account of his travels was published in 1811 under the title *Itinéraire de Paris à Jérusalem*.

He greeted the restoration of Louis XVIII with enthusiasm, and his pamphlet, *De Bonaparte et des Bourbons* (1814), was said by the king to have been worth an army of 100,000 men. In 1815, Chateaubriand was made a peer of France. He served as ambassador to Prussia in 1821, and to Great Britain in 1822, and later that year represented France at the Congress of Verona. Appointed minister of foreign affairs in 1823, he was summarily dismissed in the following year at the instance of Comte Jean Baptiste de Villèle. Indignant at this treatment, Chateaubriand attacked the government in the *Journal des Débats*. In 1826 he published *Les aventures du dernier des Abencérages*, a short novel with a Moorish theme. Appointed ambassador to Rome in 1828, he resigned in the following year. After the revolution of 1830, he refused to take the oath of allegiance to Louis Philippe, forfeiting his seat in the Chamber of Peers and a pension of 12,000 francs. He held no public offices thereafter, but continued to write, publishing a number of political and historical works. His memoirs were published posthumously, in 1849–1850, under the title *Mémoires d'outre-tombe*.

Chateaubriand was the chief precursor of the romantic movement in France. He drew attention to the literary resources of the Middle Ages and of Christian antiquity, and he induced his generation to break with the waning classical tradition. His style left its mark on poetry, history, and the novel.

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CHATEAUBRIANT, shà-tō-brē-ān', town, France, situated in the Department of Loire-Inférieure, 40 miles north-northeast of Nantes. A trading and railroad center, Châteaubriant has tanneries, flour mills, and establishments manufacturing furniture, hosiery, and agricultural implements. The remains of a castle built at various times from the 11th to the 15th century were damaged in World War II. The Château-Neuf (1533-1537), which has been restored, contains a museum and law courts. Pop. (1946) 7,965.

CHATEAUDUN, shā-tō-dún', town, France, situated in the Department of Eure-et-Loir, overlooking the Loir Valley, 28 miles south-southwest of Chartres. Rebuilt after a fire in 1723, it has straight streets terminating in a large square, the Place du 18-Octobre, at one end of which is a promenade with a view of the valley. The castle of the counts of Dunois, built from the 12th to the 16th century, is on a promontory to the west of the town. Among other notable buildings are the 12th century Church of the Madeleine, burned in 1940 and since restored; and the Church of St.-Valérien, erected from the 12th to the 15th century. A trading center for the surrounding cattle-raising region, the town has factories manufacturing telephone and optical equipment, blankets, and machine tools.

Châteaudun has been in existence since the Gallo-Roman period. In the Franco-Prussian War it was captured by the Germans on Oct. 18, 1870, after a heroic defense. It sustained some damage in World War II. Pop. (1946) 7,309.

CHATEAUGAY (in Canada CHÂTEAUGUAY), shāt'-ā-gē (Fr. shā-tō-gā'), river, New York and Canada. About 60 miles long, it rises in Lower Chateaugay, the more northern of the two Chateaugay lakes, and flows north through Franklin County, N. Y., and Châteauguay County, Quebec, into the St. Lawrence River, which it joins at a point opposite Lachine on Montreal Island. It was the scene of important military operations during the War of 1812 (see CHATEAUGUAY, BATTLE OF).

The name is derived from that of a seigneurie on the St. Lawrence River granted in 1673 to Charles Le Moyne, sieur de Longueuil, who in turn derived it from a place name in France.

CHATEAUGAY LAKES, two small lakes, New York. Upper Chateaugay, in Clinton County, is about 4 miles long. Lower Chateaugay, in the eastern part of Franklin County, is about 3 miles long; the Chateaugay River flows out of its northern end.

CHATEAUGUAY, SIEUR DE. See LE MOYNE, ANTOINE.

CHATEAUGUAY, town, Quebec, Canada, situated on Lake St. Louis (an expansion of the St. Lawrence River), near the mouth of the Châteauguay River and about 14 miles southwest of Montreal. It is served by the New York Central Railroad. Châteauguay is a market for the surrounding rich mixed farming and dairying region. Pop. (1951) 2,240.

CHATEAUGUAY, Battle of, an encounter between American and British troops which took place on Oct. 26, 1813, about 15 miles from the mouth of the Châteauguay River, Quebec, Can-

ada, during the War of 1812. The engagement, with that of Chrysler's Field (see CHRYSLER'S FIELD, BATTLE OF), was a turning point in the American invasion of Lower Canada. The general plan of the invasion was that of a converging movement of two forces on Montreal, which was protected by an army of 15,000 regulars under Sir George Prevost with strong natural and subsidiary river defenses. One of the forces, under Gen. Wade Hampton, was to strike northward from Burlington, Vt., while the other and larger, under Gen. James Wilkinson, was to descend the St. Lawrence from Sackets Harbor on Lake Ontario, the two to effect a junction at or near the mouth of the Châteauguay. Both men were under direct instructions from Secretary of War John Armstrong, the question of precedence in command between the two being left in abeyance. Hampton, thus instructed, crossed the international boundary on September 20, but, encountering opposition and difficulties in water supply, turned westward 25 miles to the settlement of Chateaugay Four Corners, N. Y. Here he spent three weeks collecting supplies, remanshaling his forces (which consisted of over 4,000 infantry troops, 20 dragoons, and an artillery train of 10 guns), threatening Prevost's St. Lawrence communications, and preparing his own. Ordered by Armstrong to descend the Châteauguay, he set out on October 20, and had made camp about 15 miles from the mouth when he was opposed a short distance below by some hundreds of troops under Lieut. Col. Charles Michel d'Irumberry de Salaberry, who was subsequently joined in a second line of defense by Col. George Macdonnell with 600 seasoned militia, thus bringing the total British forces to 1,590 men, about one fourth of whom consisted of raw troops and Indians. All except the Indians were French Canadian. Salaberry had skillfully fortified his position, and to turn his flank Hampton sent 1,500 men across the Châteauguay. They were driven back from the ford they were seeking by Macdonnell and became entangled in the woods. Confused by this mishap and by a ruse of Macdonnell, who by scattering his buglers gave an impression of a large advancing force, Hampton broke off a frontal attack which he had launched with some success on Salaberry, and retired. Three days later, learning that Wilkinson had not yet moved, and considering his own force inadequate to attack Prevost, he reascended the river to Chateaugay Four Corners. A week later he received a dispatch from Wilkinson asking that supplies be forwarded and that Hampton advance to the St. Lawrence rendezvous. To this Hampton could only answer that he was without supplies, that the junction on the St. Lawrence was now impracticable, and that he himself proposed to retire forthwith to Plattsburg. Wilkinson received this reply on November 12, a day after his disastrous defeat at Chrysler's Field. He retired across the border into winter quarters on the Salmon River, and the invasion came to an end. Losses in the Châteauguay clash amounted to less than 100 killed and wounded on both sides.

CHATEAUNEUF-DE-RANDON, shā-tō-nūf'dē-rān-dōn', village, France, in the Department of Lozère, 12 miles northeast of Mende, on a 3,980-foot hill. Formerly fortified, it is celebrated for a siege sustained in 1380 by an English garrison against troops commanded by Bertrand Du Guesclin. The English governor, hard pressed,

promised to surrender to Du Guesclin at the end of 15 days if no help had arrived. Before the time elapsed, Du Guesclin died, and his successor called on the governor to yield. The latter replied that he would surrender only to Du Guesclin. Informed of the hero's death, the governor laid his sword on Du Guesclin's bier. Pop. (1946) 257.

CHATEAURENAULT or **CHATEAURENAUD**, shā-tōr-nō', or **CHATEAUREGNAUD**, shā-tōr-nyō', MARQUIS DE (FRANÇOIS LOUIS ROUSSELET), French naval officer: b. Sept. 22, 1637; d. Paris, France, Nov. 15, 1716. He fought under the vicomte de Turenne in 1658, and three years later joined the navy. In 1664 he saw service against the Barbary pirates, and by 1672 had attained the rank of captain. Appointed rear admiral in 1673, he was active in the war with the Dutch. In 1689 he commanded a squadron which carried James II to Ireland, and he fought Admiral Arthur Herbert at Bantry Bay. He served under the comte de Tourville at Beachy Head in 1690, and off Cape St. Vincent in 1693. On Tourville's death (1701), he became vice admiral of France. In 1702 he escorted a convoy of Spanish treasure ships to Vigo, but he was badly defeated there by a fleet commanded by Sir George Rooke. Châteaurenault was created a marshal of France in 1703.

CHATEAUROUX, shā-tō-rōō', town, France, capital of the Department of the Indre, situated on the Indre River, 60 miles southeast of Tours. It has factories manufacturing woolen goods, agricultural machinery, and paper, and processing food, tobacco, and leather. The home of Comte Henri Gratiot Bertrand (q.v.) contains a museum of Napoleonic souvenirs, paintings, and other collections. Among other points of interest are the Church of the Cordeliers (13th century), the Church of St.-Martial (12th to 15th centuries), and the Château-Raoul (15th century), seat of the prefecture. The château is built on the site of a castle erected in the 10th century by Raoul le Large, lord of Déols, from which the town derives its name. From 1612 to 1736, Châteauroux was a duchy of the house of Condé, and from 1742 to 1744, of Marie Anne de Mailly-Nesle, the cynical young Marquise de La Tournelle who acquired the duchy and a princely income as mistress of Louis XV. Pop. (1946) 31,195.

CHATELET, shā-tlē', MARQUISE DU (GABRIELLE ÉMILIE LE TONNELIER DE BRETEUIL), French writer: b. Paris, France, Dec. 17, 1706; d. Lunéville, Sept. 10, 1749. She received an excellent education in languages, philosophy, physics, and mathematics, and in 1725 married the marquis du Châtelet-Lomont. In 1733 she became the mistress of Voltaire, who resided with her, first at Montjeu, and later (1734-1749) at the Château de Cirey. Her *Traduction des principes de Newton* (1756) helped to spread Sir Isaac Newton's ideas in France. Among her other published works are *Institutions de physique* (1740) and *Dissertation sur la nature et la propagation de feu* (1744).

CHATELET, town, Belgium, situated in Hainaut Province, on the Sambre River, 3 miles east of Charleroi. In a coal-producing region, it has iron and steel works and chemical plants. Pop. (est. 1948) 14,857.

CHATELET, anciently a small castle. The word is a diminutive of *château*, from *castel-*

lum, a diminutive of *castrum*; or from *castellatum*, a diminutive of *castellum*, castle. The term, in later times, has been applied to certain courts of justice, established in several cities in France. The Grand Châtelet, in Paris, was the place where the presidial or ordinary court of justice of the prévôte of Paris was kept, consisting of a presidial, a civil chamber, a criminal chamber and a chamber of police. The term signified the same at Montpellier, Orleans, etc. When Paris was confined to the limits of the old city (*cité*), it could be entered only by two bridges (Le Petit Pont and Le Pont au Change), each of which was fortified with two towers—a smaller one in the wall, facing the city, and a larger one before the bridge, toward the country. These two exterior turrets were the Grand and Petit Châtelet. The tradition that the Grand Châtelet was built by Julius Caesar, though adopted by some, is not well supported; but it is certain that the great tower was standing as early as the siege of the city by the Normans (885). The Grand Châtelet was the castle of the counts of Paris, and therefore the seat of all the royal courts of justice within the city and county, and also of the feudal court. The city had no proper jurisdiction whatever; its bailiff or provost (*prévôte*) was appointed by the king, and was president of the court (though only nominally, because he had no voice in the judgments), and, by virtue of his office, leader of the nobility. The office of provost of the merchants (*prévôte des marchands*; in other cities *maire*), established before the former, and afterward united with it for a time, was finally separated from it in 1388. The business of the Châtelet was transacted by the deputies of the bailiff (*lieutenants*), of whom there were five, three for civil causes, one chief judge of criminal cases, and a lieutenant-general of police (*lieutenant-général de la police*). The latter, indeed, was Minister of Police for the whole kingdom, and the extent of his functions and power, particularly after the new arrangement made by the celebrated d'Argenson under Louis XIV, rendered him one of the most important officers of the state. In the Châtelet, however, he held only the fourth place. The whole court of justice was composed of 57 counsellors, with 13 state attorneys and a multitude of subalterns, as 63 secretaries or *greffiers*, 113 notaries, 235 attorneys, etc. All these offices were sold. The place of the first officer of the civil chamber was rated at 500,000 livres; that of a notary at 40,000 livres. The Châtelet was first in rank after the Supreme Courts (*cours souveraines*).

CHATFIELD-TAYLOR, chăt'feld tā'lēr, Hobard C., American author: b. Chicago, March 24, 1865; d. Santa Barbara, Calif., Jan. 16, 1945. He was graduated at Cornell University in 1886. In 1888-1890 he was editor of *America*, was consul of Spain at Chicago in 1892-1894, and became a member of several honorary societies of Spain, France, Italy and Portugal. He has written *With Edge-Tools* (1891); *An American Peeress* (1893); *The Land of the Castanet* (1896); *The Vice of Fools* (1898); *The Idle Born* (1900); *The Crimson Wing* (1902); *Molière, a biography* (1906); *Fame's Pathway* (1909); *Goldoni, a biography* (1913); *Chicago* (1917); *Cities of Many Men* (1925); *Tawny Spain* (1927); and *Charmed Circles—A Pageant of the Ages from Aspasia's Day to Ours* (1935).

CHATHAM, Earls of. See **PITT, WILLIAM.**

CHATHAM, municipal borough, England, naval arsenal and seaport, in County Kent, on the Medway, 30 miles east-southeast from London, practically forming one town with Rochester. As a parliamentary borough it includes Gillingham and Rochester, and returns two members. The great features of Chatham are the naval and military establishments here and in the vicinity. The dockyard was founded by Henry VIII and enlarged by Queen Elizabeth; and during her reign Upnor Castle, on the left bank of the Medway, was erected to protect the dock and shipping. Despite the fire from the castle, however, in June 1667 Van Ghent, a vice-admiral of Michel de Ruyter, succeeded in breaking the chain stretched across the river, burned and sank several ships, and retired bearing off the warship, the *Royal Charles*, as a prize. The former lines of fortifications have been replaced by modern forts. With its extensions, the royal dockyard now extends for about three miles along the Medway, and is thoroughly equipped with building slips and floating docks, making it one of the most important naval bases in the kingdom. The military establishments include extensive infantry barracks, and barracks for the royal marines; the headquarters of the royal engineers, arsenal and park of artillery, and hospitals. The fortifications are intended as a defense for London, a protection against an invasion from the south coast. Chatham is one of the chief shipbuilding towns of England. Charles Dickens lived some time in Ordnance Place, Chatham. The remains of a Roman cemetery have been discovered at Chatham. Pop. (1946 est.) 40,400.

CHATHAM, chāt'ām, seaport town, New Brunswick, Canada, county seat of Northumberland County, on the right bank of the Miramichi River, 12 miles from its mouth, and on a branch of the Canadian National Railway, 98 miles northeast of Fredericton. It is the largest town on the north shore of the province. The harbor accommodates ships of large draught and the town has a considerable export trade in fish, tanning bark, deals, lath and finished lumber. Its manufactories include small saw and pulp mills, foundries, shipyard, sash and door factories. The town, founded in 1800, has 5 churches. Pop. (1951 est.) 4,300.

CHATHAM, borough, New Jersey, in Morris County, altitude 230 feet, 12 miles west of Newark, on the Passaic River and the Lackawanna Railroad. It is mainly a residential suburb of New York, famous for its roses. It was incorporated as a village in 1892 and as a borough in 1897. The borough owns the water supply and has a mayor and council. Pop. (1940) 4,888; (1950) 7,321.

CHATHAM, city, Ontario, Canada, county-seat of Kent County, on the Thames River, the Canadian National, Canadian Pacific, and Père Marquette railways, 45 miles northeast of Detroit and 67 miles southwest of London. Its site was chosen and named by Governor John Graves Simcoe in 1795. Chatham is center for a rich grain, tobacco, fruit and stock raising district. It is served by nine banks and is the seat of a United States consulate. It has saw, flour and

woolen mills; foundries and machine shops; canneries; manufactories of sugar, concrete and tobacco. There is natural gas in the vicinity. The city has many handsome buildings, including two large hospitals, a fine Collegiate Institute and the Ursuline Academy. Its natural attractions include Tecumseh Park, set amid beautiful scenery. It has a radio station, a daily newspaper, a Board of Trade and Industrial Bureau. Pop. (1951 est.) 20,000.

CHATHAM ISLANDS, a volcanic group politically attached to New Zealand, situated between 43° and 45° S. latitude and 176 to 177° W. longitude, 537 miles east of Lyttelton, New Zealand, to which geology and plant and animal life show they were once joined. They comprise Chatham, Pitt, and South East islands plus a few uninhabited rocks, with a total area of 372 square miles. The original inhabitants, the Moriori, of Polynesian stock, migrated there from New Zealand about 1200 A.D. When Lieut. William Broughton of H.M.S. *Chatham* discovered the islands in 1791 he estimated the population at 1,600, but there is evidence that it had been larger. Between 1809 and 1838 the islands were frequently visited by sealers and whalers. In 1835 some Taranaki Maoris seized the whaler *Lord Rodney* and forced her captain to transport 900 of them—men, women, and children—to Chatham Island where they took possession. Some of the Moriori were killed and others enslaved, while disease—measles, and especially influenza—took a heavy toll of the rest. The last pure blooded Moriori died in 1933. On Chatham Island (348 square miles) is the chief town, Waitangi. The main industries are sheep and cattle farming and fishing, the catch being shipped to Australia. Pop. (1951) 471, including 266 classed as Maori.

CHATI, shā-tē', a wildcat (*Felis mitis*), ranging from Mexico to Paraguay, in warm lowlands, and woods. The body, including the head, is from 24 to 27 inches long, the tail about 14 to 18 inches. The fur is soft and tawny, spotted with black. This cat is by some naturalists considered a variety of the margay (*Felis tigrina*).

CHATILLON-SUR-SEINE, shā-tē-yōn-sūr-sān', commune, France, in the department of Côte-d'Or, 43 miles northwest of Dijon, on the Seine. There are interesting medieval churches and a castle built by Auguste Marmont, which is surrounded by a large park. Napoleon held a congress here with the Allies in 1814. Two American armies joined forces here on Sept. 12, 1944 during World War II. Pop. (1946) 11,673.

CHATRIAN, shā-trē-än', **Alexandre.** See **ERCKMANN-CHATRIAN.**

CHATSWORTH, chāts'wūth, England, the celebrated estate of the dukes of Devonshire, situated in the parish of Edensor, in Derbyshire. It was among the domains given by the Conqueror to his natural son, William Peveril. It was purchased in the reign of Elizabeth by William Cavendish, who commenced to build a mansion on it, which was completed by his widow, the Countess of Shrewsbury. Mary, Queen of Scots, was imprisoned here for 13 years. The present building was nearly completed by the 1st duke of Devonshire, and a new wing was added by the 6th duke.

CHATTAHOOCHEE, chăt-à-hōō'chê, town, Florida, in Gadsden County, at an altitude of 68 feet, 47 miles northwest of Tallahassee, two miles south of the Georgia state border, on the Apalachicola River, where it is formed by the juncture of the Chattahoochee River with several minor tributaries. It serves as a junction for the Louisville and Nashville, Atlantic Coast Line, Apalachicola Northern, and Seaboard Air Line railroads. The name of the town is from the Seminole Indian language, meaning "marked rock." The town's main industry is the tending of the Florida State Hospital for the Insane, founded there in 1876. This is a huge institution, the largest of its kind in Florida, and it has the unique distinction of being the only hospital in the state admitting all indigent residents, white or Negro, free. There are over 4,000 patients here, living in white green-roofed buildings that are scattered about the spacious, landscaped grounds. The institution is a town within itself, containing a funeral home, barber shop, beauty shop, and a police and fire department. Pop. (1950) 8,466.

CHATTAHOOCHEE, river, in the north-eastern part of Georgia, rising in the Appalachian Mountains, and flowing first west and then south, forming for a considerable distance, the boundary between the above state and Alabama. In its lower course, after the junction of the Flint River from the east, it is named the Apalachicola River and is navigable to Columbus for steamboats. Total course, about 410 miles.

CHATTAHOOCHEE STAGE, in American geology, rocks laid down in older Miocene, or according to more recent authorities, in Oligocene time along the Atlantic coast of what was then the continent of North America. Strata of this stage probably extend, except for a break in Maryland and Virginia, from Cape Cod to Texas, and in the north are clays and uncompact sand, changing to limestones in the south. See also OLIGOCENE SERIES; TERTIARY SYSTEM.

CHATTANOOGA, chăt-à-nōō'gā, city, Tennessee, port of entry, and Hamilton County seat; altitude 674 feet; on the Tennessee River; on the Nashville, Chattanooga and St. Louis; Tennessee, Alabama and Georgia; Central of Georgia; and Southern railroads; on federal and state highways; 110 miles southwest of Knoxville. There is a municipal airport with service from three major airlines. The Georgia state line is part of the city's southern boundary, and the middle of the Tennessee River (here making a rectangular turn on the east side of Moccasin Bend) forms part of the north and east line of the city. Across the river to the north is the suburb of North Chattanooga; beyond it is Signal Mountain, rising sheer above the Grand Canyon of the Tennessee, with Raccoon Mountain on the south bank. South from Raccoon, just outside the city limits, is Lookout Mountain. The eastern slope of Missionary Ridge is the city limit on the east. Several national highways enter the city by tunnel. The business section is near the river with two bridges a block apart (Walnut and Market Streets); even here the contour is sharply broken by Cameron Hill with Boynton Park and an observatory. The Union Station serves the first two railways named; the Terminal Station, about five blocks

further from the river, serves the other two. South of the tracks, connecting the two stations, the main factory section extends across the Georgia line. The better residential sections are on the slopes of the hills and across the river in the suburbs of North Chattanooga and Dallas Heights. Just over the Georgia line is Fort Oglethorpe, at one time a United States Army Post, and the main part of the Chickamauga and Chattanooga National Military Park (1890; 8,456 acres). The other large part of this park is on Lookout Mountain (3,000 acres, taken over in 1935 from a mountain park planned and in part financed by Adolph S. Ochs). Orchard Knob, on the eastern edge of downtown, is also a part of the Military Park, which preserves with appropriate markers and reconstructed roads, the fields of the battles of Chickamauga (q.v.) and Chattanooga (see CHATTANOOGA, BATTLE OF), the former (Sept. 19-21, 1863) a defeat; and the latter (Nov. 24-25, 1863) an important victory for the Union Army, making possible Sherman's march through Georgia. In downtown Chattanooga are the Confederate Cemetery on Third Street, and the 20-block National Cemetery with 15,000 graves. In the Union Station is exhibited the "General," a locomotive used in April 1862 by 21 Union raiders, led by James J. Andrews, Federal spy, in an attempt to cut Confederate rail communications from Atlanta. They were captured near Chattanooga, and Andrews and seven of his men were executed.

Public Buildings.—In the city the principal buildings are: the fine modern post office and federal courthouse (1934); the 12-story Read House Hotel (1926; cost \$2,500,000), on the site of the Crutchfield House (1847); the Soldiers and Sailors Memorial Auditorium, with an arena seating 5,500; the first Presbyterian Church (1910), with windows by Blashfield; the Ochs Memorial Temple (1928), gift of Adolph S. Ochs in honor of his parents; and the Tudor Gothic quadrangle of the University of Chattanooga on a 15-acre campus.

Educational Facilities.—With two outstanding preparatory schools for boys and one for girls, a university, and a well-organized public school system, Chattanooga is one of the leading educational centers of the South. The University of Chattanooga was established in 1886. Until 1907 this school was U.S. Grant University, sponsored by the Methodist Episcopal Church. It is coeducational, and in April of alternate years holds an institute of public affairs. The public school system includes a vocational training school. Chattanooga has a Little Theater, a Symphony Orchestra, a Civic Chorus, and an Opera Association.

TVA.—Since 1935, the city has been main headquarters of the Tennessee Valley Authority. The series of dams on the Tennessee River give Chattanooga and Knoxville access for freight to Alabama points on the Tennessee, and to the Ohio and Mississippi rivers. The city's Electric Power Board buys power wholesale from the TVA transmission system, and the rates for electric service are among the lowest in the United States. Widespread use of the TVA low-priced electricity is made by commercial and industrial consumers. Domestic consumption is now three times the national average.

Trade and Manufactures.—The nearness of the city to power and fuel supplies makes it a natural manufacturing center. The type of iron

ore available here is like that of Birmingham, Ala., and only here and in Birmingham has the southern iron industry advanced to the stage of fabrication. Chattanooga makes farm implements, oil well and waterworks machinery, structural steel, stoves, boilers, brass, copper, and other nonferrous products; also other products, including textiles, furniture, patent medicines, chemicals, and glass. The variety was great even before low rates for power attracted new industries. The surrounding country grows fruit, truck, and farm crops.

Recreation and Amusements.—The city has a considerable tourist industry. Its battlefields are studied by officers from the United States Army War College, and casual visitors come to see the Military Park and the beautiful river and mountain scenery—particularly the Lookout Mountain Incline Railway (1897; third on this site) with two cable cars, on an incline 4,750 feet long; remarkable caves reached by electric elevators; the Falls Cave, 260 feet below ground, with Ruby Falls (145 feet high) and huge stalactites; and Twin Caves, at a 420-foot level, known to the Indians and a refuge in Civil War times; and the strange rock formations of Rock City (with beautiful gardens) and Fairyland (where the Tom Thumb golf craze started in 1927), on the Georgia end of Lookout Mountain. Chattanooga has a Tri-State Fair each September. Chickamauga Lake, a 40,000-acre man-made lake created by TVA through the construction of Chickamauga Dam on the Tennessee River, has increased the popularity of many water sports.

History.—Chattanooga is an Indian name, meaning "rock rising to a point," referring to Lookout Mountain. Several Indian trails met here: the Chickamauga Path ran from the mouth of Chickamauga Creek, a little northeast of present Chattanooga, into upper East Tennessee; the Great War Path went over Lookout and then south; the Shawnee Trail led from Williams Island (northwest of the city) into the Cumberland Valley. Warlike Cherokees who settled on the Chickamauga after 1776, and were burned out in 1779 by Evan Shelby, moved west of Lookout Mountain to villages called the lower Chickamauga towns, where they were a threat to the white settlers until the Nickajack Expedition under Maj. James Ore crushed them in 1794. A ferry at the south end of Williams Island (just west of the present city) was established in 1803 by John Brown, a half-breed Cherokee. After 1815 this site became an important Indian trading post, called Ross's Landing. From 1817 to 1838, Brainerd Mission (Congregational) was carried on at a spot just outside the southeast border of the present city. This mission (established by the Rev. Cyrus Kingsbury and named for David Brainerd, 18th century missionary to New Jersey Indians) gave its name to Missionary Ridge. The first permanent white settlement was made about 1835. A post office was established here in 1837 and named Chattanooga in 1838; the town was chartered in 1839. It was a center for the salt trade from Virginia to Tennessee, and soon had considerable river trade in flour, whisky, bacon, iron, and cotton cloth. The Western and Atlantic Railroad reached Chattanooga in 1849, and in 1851 it became a city. Its river trade in cotton rivaled that of Memphis for a few years, but before the war rail transportation had become far more important than river trade;

Chattanooga had rail connection with Knoxville in 1855 and with Memphis in 1857. In the War between the States, the Union armies struck at Chattanooga in 1862 and 1863 in an attempt to separate the eastern and western armies of the Confederacy. The campaign of 1862 was a failure. That of 1863 began with the defeat at Chickamauga and ended with the success of the greatly augmented Union forces in the spectacular battles on the mountains around the city. Until the end of the war, Chattanooga was a Union base. A terrible flood in 1867 helped wash out a smallpox plague, but smallpox struck again in 1883, cholera in 1873, yellow fever in 1878. The iron industry had a faint start about that time, and in that year Adolph S. Ochs bought the *Chattanooga Times* (established in 1869) and made it a great paper and his stepping stone to *The New York Times*.

Chattanooga was one of the first cities in the country to adopt the commission form of government, and it still operates under that system. It occupies an area of 27.42 square miles. The annual average temperature is 61.4°F., the average winter temperature being 41.6° and the average summer temperature, 76.8°. The annual rainfall averages 52.02 inches.

There were concentration camps near Chattanooga in the Spanish-American War and World War I and in the latter, training camps for men, officers, and medical corps. In 1935, first TVA and then national defense measures again stimulated the city's growth and prosperity. The population jumped at every decennial census except 1900, and it more than doubled from 1920 to 1930, partly through the annexation about 1929 of suburbs with a combined population in 1920 of over 14,000; (1860) 2,545; (1870) 6,093; (1880) 12,892; (1890) 29,100; (1900) 30,154; (1910) 44,604; (1920) 57,895; (1930) 119,798; (1940) 128,163; (1950) 130,333.

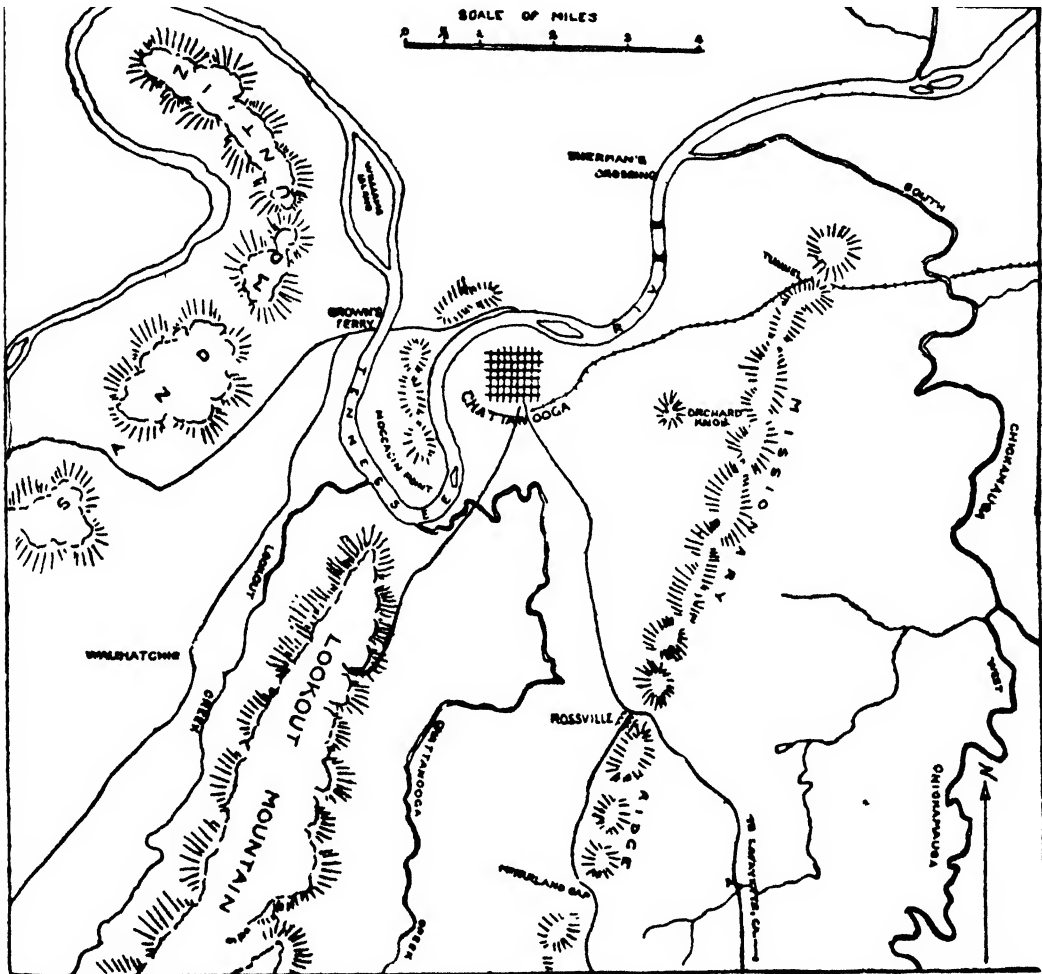
CHATTANOOGA, Battle of. At the close of the battle of Chickamauga, Ga., Sept. 20, 1863, the Union Army, in withdrawing from the field, having interposed at Rossville, Ga., between Gen. Braxton Bragg and Chattanooga, advanced into that city the night of the 21st and morning of the 22d, and immediately began to fortify it. Bragg followed on the 22d, and his lines were soon established in front of the place, his left resting on the Tennessee River and Lookout Mountain, below the city, his center extending across the plain to the foot of Missionary Ridge, his right being established at the foot of the ridge and reaching toward the Tennessee River above. (See map, page 357.) The advance line of the Confederates was half way between the ridge and the city, upon a low intermediate ridge, at the right of which was Orchard Knob, an isolated knoll rising some 60 feet above the plain.

Lookout Mountain commanded the river line to Bridgeport and Stevenson, the main depots of supply. This necessitated a wagon-haul of 60 miles over the Cumberlands and the adjacent range of Walden's Ridge, all precipitous and barren mountains. The Union army was soon running short of supplies, the fall rains rendering the roads almost impassable. On October 19, the day that Gen. William Rosecrans had perfected the general features of a plan for regaining the river line of supplies, he was relieved from command and Gen. George H. Thomas assigned, who at once ordered the preparations inaugurated by Rosecrans to go forward.

Immediately after the battle of Chickamauga, Gen. Joseph Hooker with the 11th and 12th corps was sent from the Army of the Potomac and arrived at Bridgeport, Tenn., September 30. Gen. William Sherman, in camp east of Vicksburg, had been ordered up with four divisions. Gen. Ulysses Grant was sent to take general command. Upon arriving, October 23, he approved the plans for opening the river, and directed their execution. Gen. Hooker was to advance into Lookout Valley, and a cooperating force from Chattanooga under Gen. William F. Smith was to seize Brown's Ferry below Lookout

street's troops after three hours' fighting withdrew to the east side of Lookout, and the Wauhatchie or Lookout Valley remained thereafter in Union control. Abundant supplies by the river then reached Chattanooga by a short wagon-haul from Brown's Ferry. On November 4, shortly after the Battle of Wauhatchie, Longstreet's corps was detached by Bragg and sent to Knoxville. (See CAMPBELL'S STATION.)

The Battle of Chattanooga, which occurred three weeks later, embraced three days' operations, November 23, 24, and 25. At the opening Bragg's lines were as already described. Hooker



Chattanooga, Tenn., and vicinity.

Mountain, throw a bridge there, and form a junction with Hooker. These movements were successfully executed during October 27 and 28. The 11th corps (two divisions) and Geary's division of the 12th corps entered Lookout Valley the afternoon of October 28, the 11th corps proceeding to Brown's Ferry and formed a junction with Gen. Smith's troops from Chattanooga. Gen. John W. Geary, with six regiments of his division, halted near Wauhatchie Station. At midnight of the 28th Geary was attacked by Micah Jenkins' (John Bell Hood's) division, six regiments of Gen. James Longstreet's corps, supported by Evander Law's division. Carl Schurz's division coming to Geary's support, Gen. Long-

occupied Lookout Valley, the Army of the Cumberland and the 11th corps were on the lines about Chattanooga, and Sherman with three divisions had crossed at Brown's Ferry and was concealed behind the hills above Chattanooga and on the opposite side of the river from the city.

General Grant's force for his firing lines was about 60,000, and the Confederates' a little less than 40,000. The formidable natural positions of the latter were held to give them superior advantages.

Grant's plan of battle was for Hooker to hold Lookout Valley against Bragg's left. Sherman was to cross the Tennessee opposite the north end

of Missionary Ridge, which was unoccupied, and carry it to the railroad tunnel about half a mile south of its northern end. Sherman, then, astride of the ridge, was to move south; while Gen. George Thomas, with the Army of the Cumberland before the city, was to connect its left with Sherman's right, and together sweeping south they were to clear the ridge and the valley. As the engagement progressed, every feature of this plan was changed by unexpected developments.

At noon, November 23, General Thomas, being directed by Grant to ascertain if the Confederates still occupied their lines and camps between the city and Missionary Ridge, paraded five divisions in full view of the Confederate positions, which, as was afterward ascertained, was at first supposed to be a review. Thomas Wood's division was in the center advanced, Schurz's and Steinwehr's divisions of the 11th corps were reformed on the left, and Phillip Sheridan's and Absalom Baird's on the right. At a bugle signal at 1:30 P.M. the center advanced rapidly, and, after a sharp contest, captured Orchard Knob, and forced the abandonment of the entire line of the Confederates through the center of the plain, reversed the works at and near the Knob and held them. This was the first day's battle.

The night of the 23d Sherman with three of his four divisions, which had reached his concealed camps opposite the city and north of it, marched to the North Chickamauga, where 116 pontoon boats awaited him. These were filled with soldiers, floated down the creek to the river, and thence to the opposite shore, and by daylight of the 24th, 8,000 of Sherman's troops were in line fronting Missionary Ridge, two miles from it, and opposite its northern extremity, which point was not occupied by the Confederates until 2:30 in the afternoon. At 1 o'clock the three divisions, and one from the Army of the Cumberland which had covered the movement having crossed, the lines were advanced, and at 4 o'clock a range of unoccupied hills north of and overlooking the north end of Missionary Ridge was occupied without resistance, and strongly entrenched under the supposition that these formed the north end of the ridge contemplated in the order of battle. The mistake was due mainly to the misty weather, and the omission of any reconnaissance.

At 2:30 P.M. Patrick Cleburne's division arrived at the north point of the ridge and entrenched.

Gen. Thomas, having obtained Grant's permission to make a demonstration against the Confederate position on Lookout, made ready to move at an early hour on the 24th.

The Confederates held the top of the mountain, which was a narrow plateau 1,700 feet above the valley, protected by perpendicular palisades varying from 75 to 250 feet high. From the foot of the walls of rock the mountain sloped westward to Hooker's position in Lookout Valley eastward to the plain south of Chattanooga, while its north slope descended to the Tennessee River opposite Moccasin Point. It was approximately a mile and a half from the foot of the palisades to the valley. The battle took place on these slopes. No Union troops reached the top of the mountain during the engagement. The morning of the 24th, part of Stevenson's Confederate division occupied the summit, and part of Cheatham's division the slopes of the mountain.

Hooker's aggregate strength was something over 9,000. The Confederates, who sustained almost the entire attack until the western and northern slopes had been carried, did not number over 1,700.

The head of Hooker's column crossed Lookout Creek at Light's Mill near Wauhatchie, at 8 o'clock in the morning, and, concealed by the fog which hung over the mountain, marched directly up the western slope until the head of the line reached the base of the palisades. His line then faced toward the north point of the mountain, distant about two miles.

After an advance of a mile and a half with Geary's brigades, the troops struck the left flank of Walthall's line protected by slashed timber. This was carried, and in the face of stout resistance the Confederates were driven around the north point of the mountain, and across its northern slope. As Geary's attack opened, it was joined by other brigades, and it advanced with the swinging movement on the slopes of the mountain. Until the northern slope had been carried to the Craven House, the Confederates had no assistance. Their relief arrived after they had withdrawn some 400 yards from the Craven House. This position was held until 3 o'clock in the morning, when, the troops and supplies from the top having been withdrawn and safely started across the plain for the Missionary Ridge line, this final line was also withdrawn, and the mountain abandoned. The troops on the summit, on account of the fog, could do little damage to the Union lines. Hooker was materially assisted by batteries on the elevated points in Lookout Valley, and those across the river on Moccasin Point, which swept the northern slope. The next morning the Union forces occupied the summit.

The capturing of Lookout Mountain decided Gen. Bragg to withdraw his whole army from the plain to the crest of Missionary Ridge, except as heavy picket forces were left in the entrenchments at the base of the ridge.

Hooker's losses at Lookout, and the next day at Missionary Ridge, which were small but not definitely reported, were: killed, 81; wounded, 390. The Confederate loss was: killed, 21; wounded, 177; captured, 845; and missing, 208.

During the night of the 24th and the early morning of the 25th, Bragg concentrated his army on Missionary Ridge, and in the earthworks at its base. This was his first occupation of the crest of the ridge in force. His new line extended from Rossville, a distance of eight miles, to the north end of the ridge, and was composed of seven divisions.

The battle of the 25th opened soon after 7 o'clock by an assault of Sherman upon the north end of the ridge, defended by Cleburne. While some brigades reached the crest at different periods, none was able to maintain position there. The fighting of the troops sent in was persistent and most courageous, but Cleburne repulsed all assaults. The last one, about 3:30 P.M., was especially serious.

Grant, on Orchard Knob, observing this repulse, ordered Gen. Thomas to advance his four divisions at the center against the earthworks at the foot of the ridge as a diversion in favor of Sherman, hoping thereby to cause the withdrawal of Confederate forces from his front. The line was two and a half miles long, and faced the ridge at distances from three-quarters

of a mile to a mile from it. There were 11 brigades and 89 regiments in the lines as prepared for the assault. At a signal of six cannon shots from Orchard Knob the four divisions rushed for the earthworks at the foot of the ridge. On the summit opposed to this advance were 13 brigades and 16 batteries. The cannonading of nearly 100 guns from the crest was terrific, and the line was soon under rifle-fire from the works at the base, but the entire line of earthworks was captured as soon as the troops by running could reach them. Reforming their lines in the earthworks, Baird's division on the left and Johnson's on the right began the storming of the ridge without further orders. At the center in Wood's and Sheridan's divisions the orders as understood by most were to stop at the rifle-pits, but the men ignored these and started forward, and soon orders were received to go to the top. The whole line of brigades gained the crest so nearly together that it has always been difficult to determine which, if any one, was the first.

The long lines of the storming party moved up the slopes with few checks, and in an hour had carried three miles of the crest and captured 7 guns and about 2,000 prisoners.

Just as the orders were given Thomas for his assault at the center, Hooker, who had descended Lookout at 1 o'clock and started to attack the south end of the ridge in Rossville Gap, reached that position. He had been detained by the necessity of rebuilding a bridge over Chattanooga Creek. He at once sent a division through the gap and turned it north along the east side of Missionary Ridge. Another Union division assaulted and carried the south end of the ridge in the gap while Geary moved along the western base of the ridge and finally ascended to the crest, reaching it soon after the right of Thomas' assault had occupied it.

As Baird's division reached the crest, it turned northward and became hotly engaged with a Confederate brigade. Darkness coming on, the fighting ceased.

The losses at Chattanooga, including the three days' battles and the affairs in pursuit to Ringgold, were for Grant: killed, 753; wounded, 4,722; missing, 349; total, 5,824; for Bragg: killed, 361; wounded, 2,180; missing, 4,146; total, 6,687.

H. V. BOYNTON.

CHATTANOOGA, University of, an independent, endowed, accredited coeducational institution founded at Chattanooga, Tennessee, in 1886 by the Methodist Episcopal Church.

Through its colleges of Liberal Arts, Applied Arts, Fine Arts, and Division of Graduate Studies, the university offers accredited curricula in languages and literature, social studies, philosophy and religion, science and engineering, home economics, teacher training, physical education and health, military science and tactics, business administration, dramatics, art, and music. Two-year or junior college certificate programs are available in liberal arts, accounting, cooperative retailing, home economics, and secretarial science. Standard pre-professional work is offered in medicine, nursing, law, engineering, teaching, and ministerial training. Graduate work is currently limited to the master's degree in education, chemistry, and music. Through Chattanooga College the university offers a wide variety of late afternoon and evening courses on a credit and non-

credit basis to adults in the Tri-State area. A Senior ROTC unit is maintained on a voluntary basis.

The campus consists of twenty-five acres and twenty permanent buildings and is centrally located on a hill top in downtown Chattanooga. The value of the university plant is \$4,109,000 and the endowment totals \$1,200,000. The income from the annual alumni and citizens Sustaining Fund averages \$50,000. The Library contains more than 50,000 volumes with special TVA, scientific, and southern history collections. The Chattanooga Public Library, containing some 100,000 volumes, is housed in the same building, thereby making the combined facilities available to faculty and students. The university sponsors institutes, short courses, art exhibits, dramatic productions, and musicals, and serves as a cultural center of the area.

In 1950-1951, the faculty consisted of more than 100 teachers; the enrollment in the day colleges averaged some 1,200 students, and the evening college numbered about 600. There is also a summer school of two six-week sessions enrolling some 800 students each year. The Cadek Conservatory of Music, the preparatory division of the university, has a separate faculty of some 40 teachers and enrolls some 1,400 students annually on a noncredit basis. The Industrial Research Institute of the University engages in fundamental and applied research in the fields of science and engineering on a non-profit basis for local and national industries, government agencies, and foundations.

DAVID A. LOCKMILLER,
President, University of Chattanooga.

CHATTEL, chăt'tl (O.F. *chatel*, property), property movable and immovable, not being freehold. The word chattels is originally the same word with cattle, all property being reckoned in early periods by the number of heads of cattle possessed, or their equivalent. Chattels signified originally only movable property, but in course of time came to be applied to all property not held in feudal tenure. Chattels are divided into real and personal. Chattels real are such as belong not to the person immediately, but dependently upon something. Any interest in land or tenements, for example, is a real chattel; so also is a lease, a rent for a term of years, an interest in advowsons, etc. Chattels personal are goods which belong immediately to the person of the owner, and include all movable property. Chattels usually pass to the executor, except such, for instance, as trees, which may not be severed from the freehold, and therefore pass to the heir. But objects forming part of the real estate may become chattels upon being separated from it, as for example, ore, oil, timber, etc. *Chattels personal*, at common law, are transferable by agreement, when the transfer is made for a consideration; but if the transfer is made through a gift, the delivery of the chattel is necessary to confer title on the guarantee. Chattel is a more extensive term than goods or effects.

CHATTEL MORTGAGE, a transfer of personal property as security for a debt in such manner that upon default the chattel becomes the property of the mortgagee. In the absence of statute no special form is necessary, the terms depending to a great extent on the intention of the parties. Between the parties to a

mortgage, a delivery is not necessary, but to be binding on creditors, delivery to the mortgagee or notice to the creditors is necessary. In mortgage, title and possession pass; in pledge, possession passes, but title remains in the pledgor. At common law it was necessary for the chattel to be in possession of the mortgagor at the time the mortgage was given, so as to be binding against creditors; but if the mortgagor acquired title after the mortgage had been given, it was good as between the parties, but not as to creditors. In equity a chattel mortgage is considered in the nature of an executory agreement. See MORTGAGE.

CHATTERERS, formerly the popular name of certain inessorial birds of the family Ampelidae, genus of *Ampelis*, as the Bohemian chatterer or waxwing (*A. garrulus*) and the chatterer of Carolina (*A. cedrorum*). Now the *Cotingidae*. See WAX-WING.

CHATTERJI, chăt'tēr-jē, or **CHATTO-ADHYAYA**, Bankim Chandra, Indian novelist: b. Katalpara, Bengal, India, June 27, 1838; d. April 8, 1894. Bankim's father was an official in the service of the government. Bankim Chandra was educated both at Hugli College and at the Calcutta Presidency College. He was the first to receive the B.A. degree from the Calcutta University in 1858. In recognition of his services as a magistrate, the British authorities conferred on him the titles of Rai Bahadur and C.I.E. He was fond of literature even as a boy. At the age of 15, he published a book of poems entitled *Latit O Manash*. His first novel, *Durges-Nandini*, was published in 1864. This book created a literary sensation in Bengal and the author was hailed as a great literary genius. Tagore won international fame, but Bankim is called in Bengal, "The Emperor of Bengali Literature." His principal novels are *Durges-Nandini*, *Kapala-Kundala*, *Mrina-lini*, *Bisha-Brikha*, *Ananda Math* and *Indria*. Ever since the advent of the Nationalist movement in India, Bankim Chandra's *Ananda Math* has been exceedingly popular. This novel deals with the Sannyasi rebellion of 1772. The famous national song of India, *Bande Mataram*, appears in this book. This was originally used as a rallying cry against the English. The song, in part, reads thus translated:

Mother, hail!
Thou with sweet springs flowing,
Thou fair fruits bestowing,
Cool with zephyrs blowing,
Green with corn-crops growing,
Mother, hail.

Though now seventy million voices through thy mouth
sonorous shout,
Though twice seventy million hands hold thy trenchant
sword-blades out,
Yet with all this power now,
Mother, wherefore powerless thou?

This song is a source of inspiration to the Nationalists of India. In his literary life, Bankim Chandra was influenced by Ishwar Chandra Gupta. And Bankim influenced Rabindranath Tagore. In elegance of language and in loftiness of thought, Bankim's novels can be counted among the very best in any literature.

CHATTERTON, chăt'ēr-t'n, **Edward Keble**, English journalist and author: b. Sheffield

1878; d. Dec. 31, 1944. He was educated at Oxford, went to London and entered journalism, wrote on art and the drama for several journals; became sub-editor of the *Art Record* in 1902; sub-edited John Ruskin's manuscripts for the library edition of Ruskin 1902-1903; was London correspondent of the *Sheffield Weekly Independent* 1902; sub-editor of the *Daily Mail*, and editor of the *Lady's Realm* 1904-1906, and its dramatic critic in 1904-1908. He received a temporary commission as lieutenant in the Royal Naval Volunteer Reserve (1914), and was promoted to lieutenant commander (1918). His published works include *Sailing Ships: The Story of their Development from the Earliest Times to the Present Day* (1909); *Steamships and their Story* (1910); *Down Channel in the L'ivette* (1910); *The Romance of the Ship* (1910); *The Boy's Book* (1910); *The Story of the British Navy* (1911); *Fore and Aft* (1911); *Ships and Ways of Other Days* (1913); *The Romance of Piracy* (1914); *Ship Models* (1923); *Whalers and Whaling* (1925); *On the High Seas* (1929); *The Sea Raiders* (1931); *Sea Spy* (1937); *Secret Ship* (1939); *The Epic of Dunkirk* (1940); *The First Fifteen Months of War* (1941); *Fighting the U-Boats* (1941); *The Commerce Raiders* (1943); and *Beating the U-Boats* (1943).

CHATTERTON, Thomas, English poet: b. Bristol, Nov. 20, 1752; d. there, Aug. 24, 1770. Reading early became his ruling passion. Melancholy gave way to vivacity and vanity, and dreams of immortality. His father had accidentally obtained possession of a number of old parchments of the 15th century. Many of these were put to domestic uses in the family or served in the making of dolls, but several fell into the hands of Chatterton, who after a few days declared that he had discovered a treasure. He then procured glossaries of the old dialects of the country, and in 1768, when the new bridge at Bristol was completed, he inserted a paper in the *Bristol Journal*, entitled *A Description of the Friar's First Passing Over the Old Bridge, Taken from an Ancient Manuscript*. He was then but 16 years old. Upon being questioned as to the manner in which he had obtained it, he finally asserted that he was in the possession of several valuable old manuscripts, taken from an old chest in Redcliffe Church. He had been engaged for a year in the composition of several poems, which he attributed to different ancient writers, particularly to one Rowley. In 1769 he ventured to write to Horace Walpole, who was then engaged upon his *Anecdotes of Painters*, giving him an account of a number of painters who had flourished in Bristol, which Chatterton pretended to have discovered along with several ancient poems in that city, and received a polite answer. Discontented with his situation, he went to London. The favorable reception which he there met with from the booksellers inspired him with new hopes. He wrote for several journals on the side of the opposition and indulged the hope of effecting a revolution, boasting that he was destined to restore the rights of the nation. Failing to procure the rewards which he had expected, his situation daily became worse. Although extremely temperate, and often voluntarily confining himself to bread and water, he was frequently destitute even of these neces-

saries. At last, after having been several days without food, he poisoned himself in 1770, when not yet 18 years old. His works were extensively read as the public became acquainted with the history of his misfortunes. His poems, especially those written under the name of Rowley at the age of 15 years, display a vigorous and brilliant imagination, fertility of invention, and often a deep sensibility. Professor Walter William Skeat, in his introductory essay in his edition of *The Poetical Works of Thomas Chatterton* (1871), put an end to the long controversy over the genuineness of the Rowley poems, showing them to be Chatterton's own.

(Consult Roberts, Henry D., ed., *The Complete Poetical Works of Thomas Chatterton*, 2 vols. (New York 1906); Ingram, J. H., *The True Chatterton* (London 1910); Ellinger, Esther P., *Thomas Chatterton, the Marvelous Boy*, to which is added *The Exhibition*, a personal satire (Philadelphia 1930); Meyerstein, E. H. W., *Life of Thomas Chatterton* (New York 1930); Nevill, J. C., *Thomas Chatterton* (London 1948).

CHATTOPADHYAYA, Bankim Chandra.

See CHATTERJI, BANKIM CHANDRA.

CHAUCER, chô'sêr, **Geoffrey**, English poet: b. London, England, c.1340; * d. 1400. Geoffrey Chaucer, often called the father of English poetry, is the best-known English poet of the Middle Ages. His family, which came originally from Ipswich, in eastern England, has been traced as far back as 1260, when its members were often known by the name of Malyn as well as Chaucer. From the beginning they were connected with the wine business, especially as keepers of taverns; but quite early certain members of the family had associations with London. Since the name was originally Chausier—the French for “shoemaker”—it is interesting to note that the London associations were almost invariably located in Cordwainer-street Ward, the shoemakers' district. It would seem that the family had not completely lost its connection with the leather trade. John Chaucer, the poet's father, had a house in Thames Street, and it is probably there that the poet was born.

Chaucer would certainly have passed as an educated man in the 14th century, but as to how he acquired his schooling we are completely ignorant. It has been suggested, on rather slight grounds, that he may have attended the almonry school attached to St. Paul's Cathedral. Some scholars have accepted a late tradition that for a time he was a student of the law at the Inner Temple, but in this matter there seems as much reason to doubt as to believe.

In any case, Chaucer was at home in French and had acquired, by whatever means, a sufficient knowledge of Latin to read the Latin literature of most interest to him, especially the poetry of Virgil and Ovid. His knowledge of other classical writers is more fragmentary, but he made use of a considerable number of Latin medieval works which enjoyed a measure of popularity in his day. In the course of his life he acquired an adequate knowledge of Italian. He more than once mentions his love of books, and doubtless most of his rather wide but desultory knowledge was the result of his reading.

One way to advancement in Chaucer's day was through training in the household of an important person. Chaucer's father had served Edward III in one or two capacities, and it was

doubtless through his influence that in 1357 we find the young Chaucer a page in the household of the countess of Ulster, wife of Lionel, duke of Clarence, one of the king's sons. There he learned the ways of polite society, continued his education, and had an opportunity to know important people. When the countess celebrated Christmas that year at her Yorkshire house, John of Gaunt, another son of the king and later one of the most influential men at court, was present. He was Chaucer's generous and consistent patron.

By June 1367, Chaucer had become a “valetus” in the king's household, later being advanced to an esquire. When Edward invaded France in 1359, Chaucer accompanied him and was taken prisoner in the fighting near Rheims (now Reims). The king contributed £16 toward his ransom. In the negotiations preceding the Treaty of Breigny in 1360, Chaucer carried messages between England and the negotiators. Such employment was a natural prelude to his being used in more important missions.

A period of about six years, between 1360 and 1367, is a complete blank in our knowledge of Chaucer's life. Lionel was in Ireland as viceroy from 1361 to 1366, and it has been suggested that Chaucer may have been with him. The suggestion would help to account for the poet's description of a revolving house of twigs in *The House of Fame*, since it is thought that the idea was suggested by the wicker dwellings found in Ireland at that time. Chaucer could have learned of these, however, at second hand, and there are reasons for thinking that he was in the king's service for at least a part of this period.

Chaucer's Marriage.—At all events, by 1366 Chaucer was married to one of the demoiselles in the service of the queen. Her name was Philippa, and it is almost certain from the heraldic evidence on Thomas Chaucer's tomb that she was Thomas's mother and that her maiden name was de Roet. She was thus the sister of Catherine Swynford (widow of Sir Hugh Swynford), who was for many years John of Gaunt's mistress and ultimately his wife. Marriages between esquires and demoiselles of the royal household were quite common. If, as seems likely, Philippa is to be identified with the Philippa Pan' who was in the service of the countess of Ulster at the same time that Geoffrey was one of the countess' pages, their acquaintance was of long standing. Unfortunately we do not know the significance of the abbreviation “Pan'” attached to her name in the fragment of the countess' household accounts which has come down to us.

Visits to the Continent.—During the period from 1368 to 1387, Chaucer went to the Continent at least nine times. The purpose of these journeys is not always known, since the records which grant him letters of protection during his absence from the country or note the payment to him of various sums for his salary and expenses are often brief and tell us only that he was going on “secret business of the king.” But some of them give additional information which indicates that he was sometimes sent to negotiate a treaty, discuss the possibility of a military alliance, and perhaps deal with Italian bankers from whom the king had received loans. On at least one occasion he was a member of a commission to arrange a marriage between the young King Richard II and a princess of France. Most of his business took him to France, but on two

* Some authorities give his birth date as two or three years later.

of his missions he went to Italy, in 1372 and again in 1378. A remark in the *Clerk's Tale* in the *Canterbury Tales* suggests that on the latter trip he may have met the Italian poet Petrarch, but such a meeting is quite doubtful. In any case, the Italian journeys gave him an opportunity to acquire books, especially some of the works of Dante and Boccaccio, and strongly affected his literary work.

More important from the point of view of steady income were Chaucer's several positions in the civil service. In 1374 he was appointed comptroller of the customs and subsidy levied on the export of wools, skins, and tanned hides from London, with the usual stipulation that he keep the books and perform the duties in person. Such appointments were fairly normal for esquires of the king's household. He held the appointment until near the end of 1386. His new duties relieved him of attendance at court, and he was free to take up housekeeping. This he did by leasing an apartment over Aldgate, one of the city gates, where he continued to live during most of the time that he was employed in the customs. In 1382 he received the further office of comptroller of the petty customs, which he was allowed to exercise by deputy. We do not know whether he relinquished these offices voluntarily or was deprived of them. There were political changes at the time which make the latter not unlikely. Shortly before 1386, he had moved to Kent, where for a time he was a justice of the peace and briefly a member of Parliament.

Chaucer's last civil appointment (in 1389) was as clerk of the works, in which capacity his duties were to direct the maintenance and repair of Westminster Palace, the Tower of London, various manors used as royal residences, and the parks and gardens connected with these places. To these duties were added in 1390 those which fell to him when he was made a member of a commission on sewers, appointed to survey and repair the Thames embankment. While clerk of the works he was thrice on the same day robbed of the king's money, the sums approximating \$1,500 in American money. The robbers were captured, and when one of them confessed, the other two were hanged. Chaucer was not held responsible for the loss and was not replaced in office until nine months later. His advancing age, according to medieval standards, would have been a sufficient reason for retirement.

Chaucer's Sources of Income.—During most of this period, Chaucer was financially in very comfortable circumstances. His income was by no means confined to the salaries which went with his offices. The king encouraged vigilance on the part of his comptrollers of the customs by rewarding them with the value of the wool which anyone attempted to take out of the country without payment of duty. On one occasion Chaucer received the equivalent of nearly \$10,000 in this way. The crown also granted wardships of certain minors to those at court who were fortunate enough to receive such favors. These could be very profitable. From one such grant Chaucer derived approximately \$15,000 over the space of three years. From another he received a certain amount—we do not know how much.

On occasion Chaucer was given various sums by the king in recognition of his services. And we have records of the semiannual payment of annuities from the king and from John of Gaunt, both to Chaucer and to his wife. In 1378 his

condition was apparently sufficiently substantial to permit him to act as surety for Sir William Beauchamp to the extent of £400 a year, a large sum in the 14th century. It is likely that during the middle period of his life Chaucer and his wife enjoyed an income of between \$10,000 and \$15,000 a year by modern reckoning.

It is worth observing that Chaucer, like Shakespeare, was an active man of affairs. The nature of the missions and employments in which he was used during the more active period of his life is a fair indication of his business ability and his tact.

Unfortunately, after 1386 his fortunes seem to have fluctuated and there were times when he appears to have been short of money. Some of the loans which he obtained from the Exchequer were probably only to insure prompt payment when instalments on his annuity were due. But others, especially in the last few years of his life, were so small as to show that he was in need of ready money. In 1388 he sold his annuity for a lump sum. It is hardly likely that as he faced old age he would have sacrificed continuing security unless he had some pressing need for a substantial sum of money. In 1398 he and one John Goodale were sued for £12 and £13, respectively. The knowledge which he shows of the dishonest practices of alchemists in the Canon's Yeoman's prologue and tale in the *Canterbury Tales* and the warmth with which the speaker at times expresses himself cause one to wonder whether Chaucer himself had ever fallen a victim to their practices. This of course is pure conjecture.

An added adversity, which probably befell him in 1387, was the loss of his wife. Since the last payment to her on her annuity was made in June of that year, it is assumed that later in the course of the year she died. There is no proof that Chaucer owed any of his worldly success to her influence, but it would seem that her social position was slightly better than his. In 1386, along with Henry, earl of Derby (son of John of Gaunt, and one day to be King Henry IV), and six others, she was admitted into the fraternity of Lincoln Cathedral. John of Gaunt, who with other distinguished people had been admitted in previous years, was present on the occasion, and it was apparently something of an honor. We can but observe that Philippa was so honored and Geoffrey was not. It may be noted also that she was seemingly in high favor with John of Gaunt.

Chaucer's Last Years.—In the last years of his life (by 1395) Chaucer was apparently in the service of Henry, earl of Derby, though we do not know in what capacity. When on Sept. 30, 1399, Henry was declared king, Chaucer promptly sent him a copy of his little poem, *A Complaint to His Empty Purse*, with an additional stanza of compliment. The new king was equally prompt in his response. On Oct. 13, the day of his coronation, he granted Chaucer an annuity of 40 marks a year in addition to the annuity of £20 which he had from Richard. Chaucer lost the letters patent—he was obviously getting old—and he had to be granted an exemplification, or reaffirmation, of the grant. Two months later, he leased a house in the garden of St. Mary's chapel, Westminster Abbey. According to an inscription on his tomb in Westminster Abbey, he died Oct. 25, 1400.

There are problems in Chaucer's biography

which still are somewhat obscure. In 1390-1391 he was appointed joint forester of North Petherton Park in Somersetshire, and in 1397-1398 sole forester. What his duties were is not known, but it is not clear how at his age he could have discharged very actively the duties of an office at such a distance from the place where he was living—apparently in London or Greenwich. Some years later Thomas Chaucer held the same post.

Another detail about which there is a sharp difference of opinion is the record of a deed in 1380 in which a certain Cecilia Chaumpaigne released Chaucer of her rights of action against him "*de raptu meo*." In view of the vague way in which the word *raptus* was used in charges of the time, it is generally assumed that Chaucer, and others, were involved in a case of abduction, possibly to prevent or control Cecilia's marriage. However, an article written from a modern legal point of view (P. R. Watts, "The Strange Case of Geoffrey Chaucer and Cecilia Chaumpaigne," *Law Quarterly Review*, 63:491-515, London 1947) argues for the strict interpretation of the matter as one of rape. The question is by no means settled.

The only child mentioned by Chaucer is his "little son Lewis" for whom he prepared the *Astrolabe*, an elementary treatise on the instrument. But it is fairly certain that another son was the Thomas Chaucer who became speaker of the House of Commons and was one of the regents governing the country during the infancy of Henry V. An Elizabeth Chaucy, toward whose expenses John of Gaunt contributed £51 when she became a nun in the exclusive convent of Barking, may have been a daughter. Concerning an Agnes Chaucer and one or two others who are mentioned in contemporary records we know nothing.

Literary Career.—From what has already been said it is clear that for Chaucer writing was an avocation. While we need not suppose that his reputation as a poet had no effect upon his position at the court, we may be sure that he read and wrote poetry chiefly because he enjoyed doing so. At the time he wrote his first important poem, *The Book of the Duchess*, he was already intimately acquainted with the 13th century *Roman de la Rose*, on which all poets in the 14th century seem to have been brought up, and with a number of poems of the French poet Guillaume de Machaut, totaling several thousand lines. The acquaintance is proved by innumerable echoes of phrases, lines, and sometimes longer passages of these poems in *The Book of the Duchess*. It is clear that most of his reading at this time, apart from Ovid, was in French poetry, upon which his own early work was modeled almost exclusively, reflecting the fashions and conventions in vogue in France at the time.

His two journeys to Italy broadened his horizon. Sometime between the writing of *The Book of the Duchess* and *The House of Fame*, he had read at least a part of Dante's *Divine Comedy*, a work which he may have acquired on his first trip. After his second trip, on which he must have obtained a collection of the more important works of Boccaccio except the *Decameron*, there is frequent evidence in his work of his reading in Italian literature. He did not forget what he had learned from French poetry, but the influence of Boccaccio became increas-

ingly evident and is most apparent in the *Knight's Tale* and in *Troilus and Criseyde*. The division between a French period and an Italian period in Chaucer's work, if properly understood, is not without value; but the line must not be sharply drawn, and it must be remembered that his interest in French poetry continued throughout his life.

The last phase of Chaucer's work, represented mainly by the *Canterbury Tales*, is often called his English period. Having made his own all that he had learned from French and Italian literature, and having acquired the mastery of his art which enabled him to follow his own intuition, he wrote without thought of models and conventions. The artist had become the man.

By his own admission Chaucer made many "ballades, roundels, viroles" for Love's festivals. Most of these are lost, but a score of shorter poems survive, some written early in his life, others scattered through his career. Besides love poems belonging to standard French types there are humorous and satirical ballades and conventional religious poems. One of the earliest, his *A.B.C.*, is a conventional prayer to the Virgin, supposedly written at the request of the Duchess Blanche, first wife of John of Gaunt, and based upon a French original by Guillaume de Déguileville.

The love complaint is represented by the *Complaint unto Pity*, whom he found dead, and the *Complaint to His Lady*, who is compounded of all virtues except pity for the poet. The *Complaint of Mars*, with its astronomical imagery, is thought by some to reflect a court intrigue. The ballade of *Rosamonde* is a courtly love address to a lady and is short and graceful. A group of ballades, *The Former Age*, *Fortune*, *Truth* (his best-known short poem), *Gentillesse*, and *Lack of Steadfastness*, are associated by a common dependence, at longer or shorter range, upon the Roman philosopher Boethius, though the ideas are supplemented from other sources. The *Envoy to Scogan* and the *Envoy to Bukton* (1396) are humorous epistles, the former seeking help from a friend at the court, the latter whimsically counseling his friend against marriage. The charming little *Words to Adam Scryveyn* is later than his translation of Boethius and *Troilus and Criseyde*, both of which are mentioned in the poem, and humorously complains about his too often having to correct the mistakes of his copyist. The *Complaint to His Empty Purse* has already been mentioned. Its envoy to Henry IV probably represents the last bit of verse that he wrote.

That Chaucer made a translation of the *Roman de la Rose* is certain, and it would be natural to think that it was one of the undertakings which he first attempted and in which he served his apprenticeship in verse. The translation (about a third of the poem) which is usually printed in editions of his works is almost certainly not all his. There is nothing, however, in the first 1,705 lines to hinder us from believing that this portion is by Chaucer. The rest contains non-Chaucerian rhymes and is characterized by other features which lead most scholars to reject these later sections from the canon of his writings.

In September 1369, John of Gaunt's wife Blanche died of the plague, one month after Philippa had died from the same cause. *The Book of the Duchess*, written soon after, is an

elegy in her honor, intended for the duke. After an introductory episode telling the story of Ceys and Alcione (Ceyx and Halcyone), which admirably sets the key for what follows, the poet describes a vision in which he is led to a disconsolate knight dressed in black and sitting dazed at the foot of a tree. In the course of the conversation the knight reveals the cause of his grief and describes the beautiful woman whom he has lost. The poem is full of echoes of Chaucer's reading, but the plan is his own.

In spite of the opinion of many critics the poem has very real virtues, not the least of which is the delicate way in which Chaucer contrives to put all the compliments to the lady in the mouth of her bereaved husband. Nor can one praise too highly the restraint which Chaucer shows in bringing the poem quickly to an end when the knight finally reveals the nature of his loss in unequivocal terms, thus avoiding the danger of oversentimentalizing the situation. It is Chaucer's first original long poem, and as a first poem is one of which any poet could be proud.

Chaucer as a court poet was naturally also an "occasional" poet. There were frequent occasions to which he would be expected to pay poetical tribute or on which he would have an opportunity to produce a poem of timely interest. *The Book of the Duchess* was such a poem, and what was probably his next long poem seems to have been begun with a similar purpose in mind. *The House of Fame* (1379?) superficially appears to be merely a humorous account of the poet's feelings and experiences in being carried by an eagle through the air, but in the beginning much is made of the fact that his life is so confined by his duties at the customs house and his habit of burying himself in books after his work at the office is done that he knows nothing of what is going on either at home or abroad, especially "tydynges of Loves folk." It is for this reason and because he has long served Cupid unrewarded that Jove has sent the eagle to transport him to where he will hear new things. After visiting the hall of the goddess Fame, he goes to the house of Rumor, where all kinds of reports, true and false, together with gossip and rumors of every sort, jostle one another. In the latter place he is making his way to a corner where "men of love-tydynges tolde" and where he sees "a man of gret auctorite." It is natural to expect an authoritative announcement of some sort, but with these words the poem breaks off in the middle of a sentence.

Whether the end of the poem is lost or whether the announcement to which it seems to be leading up was of something which failed to materialize we do not know. The poem is a mock epic, but its division into three books, each with its proem or invocation, and its account of a marvelous journey under the conduct of a knowing guide are reminiscent of the *Divine Comedy*; certainly the eagle was suggested by a passage in the *Purgatorio* (canto 9). The poem reveals signs of haste, and in it the poet expressly disclaims any intention of showing "art poetical," but in spite of obvious faults it remains one of the most self-revealing and delightful of the poet's works.

The Parlement of Foules (*The Parliament of Fowls*) was written probably in 1381, and the time of the action is St. Valentine's Day. Three royal or noble eagles present their suits to the beautiful female eagle that is perched on Dame

Nature's hand. All about are lesser birds of various classes. In the end the female eagle asks for a year in which to decide on her choice for a mate. The poem is most generally believed to represent under the guise of birds the preliminaries to a marriage between Richard II and Anne of Bohemia, sister of Wenceslaus, emperor of the Holy Roman Empire. The marriage took place January 14, 1382. The remarks and bickerings of the lesser birds are an amusing commentary on contemporary society, and the structure of the poem shows considerable improvement over that of *The House of Fame*.

Troilus and Criseyde is Chaucer's greatest artistic achievement. The tragic love story is an episode of the Trojan War and makes its first appearance in the 12th century French romance, the *Roman de Troie*, where it occupies intervals in the fighting. It was made the subject of Boccaccio's *Filostrato*, which was almost certainly one of the books Chaucer acquired on his second trip to Italy and which is the direct source of his poem. Chaucer's poem is by no means a slavish imitation. He took over only about a third of his original, so that a large part of the more than 8,000 lines of his poem is without direct parallel in his source. His most important debt to Boccaccio is for the theme and plot, and the outlines of the principal characters. But those characters he has in part altered and everywhere deepened; it is in characterization that the poem is especially distinguished.

Criseyde, young, beautiful, made to be loved, is a woman concerning whom men (and women) will probably always disagree. She is not a mere type, as are so many heroines of medieval romance, but a woman of great complexity, possessing strengths and weaknesses, and even her share of contradictions, so that she refuses to be neatly labeled and filed away in one's mind. In short, she is completely human. The poem has some of the qualities of the romance, but resembles even more the modern psychological novel. It could be thought of as a novel in verse. An unusual astronomical allusion in the third book indicates that Chaucer was working on it in 1385.

The translation of *De Consolatione Philosophiae* (*The Consolation of Philosophy*) by Boethius is thought to have been done shortly before the *Troilus* since its influence on the poem is quite clear. It is just as certain that *The Legend of Good Women* is later, because the *Troilus* is mentioned in it as one of Chaucer's poems at which the God of Love took offense. It consists of a lengthy prologue, at the end of which the god requires the poet to make amends by telling the stories of women who had suffered through loving faithfully. The number was apparently to be 20, forming a lectionary in which the martyrs were Cupid's saints. The poem is unfinished and breaks off in the course of the ninth legend. The prologue, much the most interesting part of the poem, exists in two very different forms. The revised form is pretty certainly to be assigned to some time after the death of Queen Anne, since the lines directing the poet to present it to her when finished are omitted. The earlier version was formerly dated 1386, but the grounds for this opinion have been shaken, and a more recent hypothesis identifies Alceste (Alcestis) with Joan, the "fair maid of Kent," widow of the Black Prince. Her sudden death in August 1385 would have been a sufficient reason for inter-

rupting work on the poem. The more usual explanation of its unfinished state is that Chaucer found writing about "good women"—good in the sense that they died for love—too monotonous.

Doubtless he had also thought of a better plan for a series of stories, the plan of the *Canterbury Tales*. The idea of tying together a collection of stories by means of a narrative framework, the "framed tale," is an old one. Examples are the story of the Seven Sages (the Seven Wise Masters), which Chaucer probably knew about, the *Decameron*, which he almost certainly did not know at first hand, *The Arabian Nights*, and in more recent times, the Sherlock Holmes tales and the Uncle Remus stories.

A religious pilgrimage offered one of the few opportunities in the Middle Ages for people of widely different social classes to associate with one another. Chaucer represents himself as falling in with a group of 29 other pilgrims about to make the trip to Canterbury and do their devotions at the shrine of St. Thomas à Becket. At the suggestion of Harry Bailly, keeper of the Tabard Inn, where the pilgrims assemble, they appoint him their guide and agree to tell stories as they ride along. Each pilgrim is to tell four stories, two each way. The collection would thus have consisted of 120 tales had Chaucer lived to complete it. Only 24 were ever written, and two of these are incomplete.

Those we have, however, constitute a veritable anthology of the principal types of medieval literature, and the general Prologue, in which he describes in detail those who made up the company, is one of the richest collections of "characters" (in the literary sense of the word) that we have in literature. Represented in the collection are the romance (*Knight's Tale*), the court romance, or Breton lai (*Franklin's Tale*), the fabliau (tales of the Miller, the Reeve, and others), the saint's legend (*Second Nun's Tale*), the beast fable (*Nun's Priest's Tale*), the exemplum, or moral apologue (*Pardoner's Tale*), the comedy (*Monk's Tale*), the classical legend (*Man of Law's Tale*), the sermon (*Parson's Tale*), and other lesser types.

There are some 80 manuscripts of the *Canterbury Tales*, including fragmentary ones, and they differ in both arrangement and detail. Chaucer evidently worked on different parts of the collection as ideas or materials came to hand, writing separate tales or small clusters of tales which he later intended to fit together into a well-integrated whole. This, as has been said above, he did not live to do. The manuscripts which we have represent the efforts of scribes, or what we would call editors or literary executors, to put together the material which they found. Consequently the order of tales differs in different manuscripts, and modern editors have to adopt an order which seems to them most nearly conform to Chaucer's intention so far as can be deduced from the internal and external evidence. Some of the tales are united by prologues and conversational or narrative links, thus establishing "groups" or "fragments" within the whole. Some of these groups may have been combined in a single copybook or bundle in Chaucer's desk. The place of others is indicated by references to the time of day or to towns along the route. But when use has been made of all these aids the result is not certainly that which Chaucer would have adopted.

On some matters Chaucer had probably not

made up his mind, and there is clear evidence that he changed his mind on certain points as he went along. The *Shipman's Tale* was originally intended for the Wife of Bath, and it has been suggested that the *Merchant's Tale* was written first for the Friar. By the time Chaucer began the *Parson's Tale*, he had given up hope of writing four tales for each pilgrim and was thinking in terms of only one tale apiece.

Within the general framework, Chaucer has employed certain specific devices to secure contrast, increase the realism, and heighten the dramatic effectiveness of the narrative. Thus, when he himself is called upon by the Host for a story, he begins to relate an extravagant parody of medieval romance; and when the Host rudely interrupts him and demands something more worth their while, Chaucer relates the serious (and to modern readers, dull) discussion between Melibeus and Dame Prudence, his wife. On another occasion, when the drunken Miller has told about a vulgar joke played on a carpenter, the Reeve, who earlier in life had been a carpenter by trade, insists on telling an equally vulgar story at the expense of a miller. The Wife of Bath, by her vigorous proclaiming of the philosophy that the wife should assert and maintain her mastery over her husband, starts a chain reaction in the course of which the Clerk answers her claims with the story of Patient Griselda, the Merchant presents another marital problem in his story of the old man who married a young wife and was cruelly duped by her, and the Franklin still another. Thus the interplay of character, the lively conversation between tales, and the high degree of appropriateness of most tales to the persons who tell them combine to make the *Canterbury Tales* a veritable *comédie humaine*.

We have several pictorial representations of Chaucer, drawn either from life or from memory shortly after his death. They agree fairly well in showing a man late in life, with a mustache and slight beard, short rather than tall, and somewhat portly. His face seems placid, even a little sad, but we can hardly doubt that in the prime of life it would have shown traces of the kindness, humor, and whimsicality which his poetry shows clearly were part of the man. He was a friendly spirit.

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ALBERT C. BAUGH,
Department of English Language and Literature,
University of Pennsylvania

CHAUCHAT, shō-shā', **Jacques Louis Henri**, French army officer and firearms inventor: b. Paris, 1863; d. there, 1927. A graduate of the Ecole Polytechnique in 1885, he became an artilleryman, and from 1895 specialized as a technician in arms manufacture. Promoted major in 1905, he became a colonel in 1915. The automatic rifle called Chauchat-Sutter, which he invented in collaboration with two other technicians, passed ordnance tests in 1913, and mass production began soon after the outbreak of World War I. The Chauchat was first used effectively in the battle of the Somme in 1916. It was adopted by the American Army.

CHAUDIERE, shō-dyār', river, Canada, which has its rise in Maine, near the source of the Kennebec, and flows north for 120 miles and joins the St. Lawrence about six miles above Quebec. Between two and three miles above its mouth it forms the Chaudière Falls.

CHAUDIERE FALLS, Canada, in the Ottawa River, just above the city of Ottawa. Here the river narrows to about 200 feet and then descends 50 feet, forming the falls.

CHAUFFEUR, shō-fēr' (Fr. a "stoker"). This term has recently come into use in the English language to designate at first the engineer or motorman of a steam-driven road carriage; but by extension it is now applied to any professional machinist who operates an automobile, electrically or otherwise propelled. During the Reign of Terror in France the word was applied to members of a band of outlaws who infested the northeastern portion of the kingdom. They were led by John the Skinner. They garroted men and women and tortured others in efforts to make them disclose hidden treasure. The band was not suppressed until 1803.

CHAULIAC, shō-lyak', **Guy de**, French surgeon: b. Gévaudan (modern Lozère), c.1300; d. probably Avignon, c.1370. He practised his profession at Lyon, then at Avignon, where he was physician to three popes: Clement VI, Innocent VI, and Urban V (1342-1370). There in 1343 he composed his great work, *Inventorium sive Collectarium Partis Chirurgicæ Medicinæ*, translated into French by Laurent Joubert in 1592 under the title *Grande Chirurgie*. It was a standard manual from the 14th to the 17th centuries.

CHAULMOOGRA, chōl-mōō'grā, or **CHAULMUGRA** (*Taraktagenos kurzii*), a tree of the order Flacourtiaceæ which grows in eastern countries and from the seeds of which is obtained an oil that is valued in China and elsewhere as a remedy for certain skin diseases.

CHAUMETTE, shō-mēt', **Pierre Gaspard**, French revolutionist: b. Nevers, France, 1763; d. April 13, 1794. In early life he wandered over France and became interested in botanical studies and was studying medicine at Paris at the outbreak of the revolution and for a year following. He contributed anonymously to the *Révolution de Paris*. He became a member of the insurrectionary commune, by which in 1792 he was made delegate to visit the prisons with power to arrest suspected persons. He acquired great influence in Paris and was made president of the Commune.

In 1793 he was one of the leaders in the attacks against the Girondists, whom he treated with great harshness. Opposing Robespierre in an effort to save the Hébertists he was overthrown by the latter, who had him arrested. He was tried by the Revolutionary Tribunal and executed. He left some speeches and memoirs.

CHAUMONOT, shō-mō-nō', **Pierre Marie Joseph**, French missionary: b. Burgundy, France, March 6, 1611; d. Quebec, Feb. 21, 1693. His father was a vine dresser who committed the care of his son to his brother, who was curé at Châtillon. Pierre ran away at the age of 10 in order to study music at Beaune, Burgundy. In the course of a pilgrimage to Rome he came under the notice of the Jesuits, who induced him to become a member of their order and sent him as missionary to the Indians of Canada in 1639. He was first assigned to the Huron missions at Ossossane, where he collected material for a Huron dictionary. In 1640 he accompanied Jean de Brébeuf to a tribe living between Lake Erie and Lake Ontario and to the west of the dreaded Iroquois. This mission resulting in failure, Chaumonot went to St. Michel de Laval where he remained eight years until the settlement was destroyed by the Iroquois. Chaumonot then took the surviving Hurons to an island in Lake Huron and later to the Island of Orleans where he served as a spiritual leader for 35 years except for short absences. In 1692 he retired to Quebec, where he died.

His Huron grammar was translated into English and was published in *Transactions* of the Library and Historical Society of Quebec in 1831.

Consult his autobiography published in New York in 1658.

CHAUMONT, shō-môn', commune, France, the capital of the Department of Haute-Marne, on a height between the Marne and the Suize, 140 miles southeast of Paris by rail. It is well built, has a fine town hall, courthouse, communal college, public library, church dating from the 13th century, the ruins of a castle belonging to the counts of Champagne, and an iron bridge 1,960 feet long with 50 arches on which the railway crosses the Suize. There are manufactures of gloves, wax candles, hosiery, cotton, cutlery, leather, woolens, sugar, etc.; and a trade in grain, coal and in the iron and iron goods of the department. At Chaumont, in March 1814, was signed a treaty between Great Britain, Russia, Austria, and Prussia, in which these powers pledged themselves to accomplish the overthrow of Napoleon and restore peace to Europe. Philippe le Bon, the first who advocated the use of gas for illumination, in France, was a native. Chaumont was the headquarters of the American Expeditionary Forces under General Pershing during World War I. Pop. (1946) 15,068.

CHAUNCEY, chón'sī, **Isaac**, American commodore: b. Black Rock, Conn., Feb. 20, 1772; d. Washington, D.C., Jan. 27, 1840. He commenced his career in the merchant service, in which he became distinguished for seamanship, enterprise and energy. He entered the navy as lieutenant in 1799, and early in 1802 was appointed acting captain of the frigate *Chesapeake*, the flagship of a squadron ordered to the Mediterranean.

operate against Tripoli. In the brilliant operations before Tripoli in 1804 he bore a distinguished part. In April 1806 he was promoted to the rank of captain. In the War of 1812 the naval superiority on the lakes became an object of high importance, and Commodore Chauncey, then in command of the navy yard at Brooklyn, was appointed to command on Lakes Ontario and Erie. He commanded the Mediterranean squadron in 1816-1818 and negotiated the treaty of peace with Algiers. From 1821 to 1824, and again from 1832 to 1840, he was navy commissioner in Washington, D.C., where he remained until his death.

CHAUNCY, Charles, American clergyman and educator: b. Yardley-bury, Herts, England, bap. Nov. 5, 1592; d. Cambridge, Mass., Feb. 19, 1672. Educated at Westminster School and at Trinity College, Cambridge, he became a fellow of Trinity (1614) and professor of Greek (1624 and 1626). As a vicar of the Church of England he was twice summoned before ecclesiastical commissions and once imprisoned for his criticism of the church, submitting each time and each time regretting his submission. In 1638 he fled to New England, where he preached in Plymouth for three years, and was then pastor at Scituate, where again he was in conflict with the established church. In 1654 he was chosen to be the second president of Harvard College, with the understanding that he would not preach his unorthodox doctrines; he retained the post until his death. Many volumes of his sermons and doctrines were published.

His great-grandson **CHARLES CHAUNCY** (b. Boston, Mass., Jan. 1, 1705; d. there, Feb. 10, 1787), also a clergyman, was a liberal leader of his time. He received a master's degree from Harvard in 1724 and became pastor of the First Church, Boston, in 1727, serving it for 60 years as one of the most influential Congregational ministers in New England. He denounced the excesses of the "Great Awakening" (q.v.), the religious revival that swept New England in 1740-1745, vigorously assailing both its leading protagonists, Jonathan Edwards and George Whitefield. Chauncy stood against Episcopacy, opposing attempts to impose the Church of England system upon the American dependencies, and supported the colonists in the War of Independence.

CHAUNY, shō-nē', commune, France, Department of the Aisne, on the Oise River and the Oise-Sambre Canal, 16 miles southwest of Saint-Quentin. Completely destroyed in World War I, when it changed hands four times, it was rebuilt, but was again damaged in 1940. An industrial town, it has foundries, wire and glass works, chemical factories, and sugar refineries. It was once an important market town. Pop. (1946) 9,206.

CHAUS. See **JUNGLE CAT** OR **CHAUS**.

CHAUTAUQUA LAKE, shá-tó'kwá, a beautiful lake situated in Chautauqua County, New York. The name comes from a Seneca Indian phrase meaning "one has taken out fish there." The lake is 18 miles long and from one to three miles wide, 730 feet higher than Lake Erie and 1,300 feet above sea level. On its bank is the town of Chautauqua.

CHAUTAUQUA MOVEMENT, an influential and characteristically American development in adult education, originated in 1874 with the first Chautauqua Assembly, held on the shores of Chautauqua Lake in the southwestern corner of New York State. The original assembly, since 1902 incorporated as Chautauqua Institution, continues to flourish at Chautauqua, N. Y., providing an eight-week summer program of lectures, music, operas, and plays, and offering summer school courses (carrying university credit) in education, music, and other fields.

The idea of utilizing the summer vacation for educational purposes was the most distinctive contribution of Chautauqua to American education. Such was the prestige of the original Chautauqua that its name was borrowed by a multitude of "circuit" or traveling chautauquas, which flourished in the first quarter of the 20th century, presenting three-day or one-week programs of popular lectures and entertainments in tents in thousands of American communities, particularly in the Middle West. The original Chautauqua Assembly also pioneered in developing home reading courses, correspondence study, and university extension lecturing, thus giving an early impetus to the kinds of adult education now being carried on by libraries, extension divisions of universities, and various agencies providing formal instruction by correspondence.

The founders of the Chautauqua movement were Lewis Miller, an Akron, Ohio, manufacturer, and Dr. (later Bishop) John Heyl Vincent, a Methodist minister, both of whom had long been active in the Sunday school movement. Together they devised a plan for offering intensive training to Sunday school teachers by scheduling a conference for them during the summer vacation, when more would be free to attend. Recreation was to be combined with education through the choice of an appropriate woodland spot. The result was the Chautauqua Lake Sunday School Assembly, which met for its first season from August 4 to 18, 1874.

The Chautauqua Assembly immediately attracted nationwide attention, and its program was rapidly enlarged in subsequent years. The session was lengthened to eight weeks, embracing most of July and August. Though biblical and religious topics dominated the first assembly, public affairs received increasing attention year by year, and national leaders began to speak regularly from the platform. By the 1880's Chautauqua had established itself as a national forum for the discussion of ideas and issues in politics, international relations, economics, literature, and science, as well as religion. This leadership in the making of an informed public opinion continues. No less than seven presidents of the United States, from Ulysses S. Grant to Franklin D. Roosevelt, have visited Chautauqua, often to deliver important addresses on national policy in the great amphitheater, constructed in 1893 and seating some 6,000.

Following World War I the musical program came to rival the lecture offerings in significance. A full season of orchestral music has constituted part of the program since 1920, and the Chautauqua Symphony Orchestra has been frequently heard on nationwide broadcasts. Presentations of opera began in 1926, and in 1929 Norton Memorial Hall provided adequate facilities for regular seasons by the Opera Association and the Repertory Theater. Chamber music, choral

performances, concerts by vocal and instrumental soloists, and organ recitals also figured among the offerings.

The formal educational work of Chautauqua developed as rapidly as the public lecture program, achieving its widest scope and variety in the 1880's and 1890's. The greatest educational innovation was formal classroom instruction in the summer, which had not been attempted in any significant way until Chautauqua inaugurated it in 1874. Language study began in 1875, courses in pedagogy quickly followed, and work in the standard fields of literature, history, and science was regularly offered. A second important innovation was instruction by correspondence, which began in 1881, preceded by only a few experiments in other institutions. University extension lectures, developed in England, were introduced to America in the 1880's, with Chautauqua among the first to offer them, in 1889.

These varied educational activities added up to the equivalent of a complete collegiate program, and the Chautauqua University was chartered in 1883, with power to grant degrees. This power was sparingly used and was surrendered in 1898, the title university having already been dropped. The Chautauqua Summer Schools continued (but neither correspondence study nor extension lecturing), and they continued to offer university credit, through administrative affiliation with an established university (for a long period, New York University; more recently, Syracuse University).

In keeping with the principle enunciated by Dr. Vincent, that "mental development is only begun in school and college, and should be continued through all of life," Chautauqua inaugurated in 1878 a program of directed home reading, which reached vast numbers of Americans who never attended the programs at Chautauqua itself. The original aim was to bring to men and women who had been deprived of the opportunity for higher education "the college student's general outlook upon the world and life." A carefully selected group of books for a year's reading was provided, together with guides and supplementary articles, the latter being eventually published in a monthly magazine, *The Chautauquan* (1880-1914). Encouragement was given to the organization of local reading circles, of which approximately 10,000 were eventually formed, three quarters of them in communities under 3,500 population. The Chautauqua Literary and Scientific Circle has given diplomas for the satisfactory completion of four consecutive years of such directed reading, and approximately 75,000 persons have qualified, out of several hundred thousand readers who have enrolled at one time or another.

The success of the program at Chautauqua, N. Y., inspired persons in many communities throughout the country to organize local chautauqua assemblies, of which more than 30 had come into existence by 1886. These were, for the most part, faithful imitations on a small scale of the original Chautauqua, and they seem to have preserved that character well into the 1890's, though not affiliated with the original institution. As the number of such chautauquas increased, however, commercialism dominated the picture. After 1900 the programs tended to be of an extremely popular sort, with political oratory, inspirational lectures (of the "hearth, home, heaven" variety), and musical entertainments as the staple features. "Talent" was usually supplied by

commercial lecture bureaus, and the most enterprising of these developed the "circuit" or traveling chautauquas or camp meetings, which toured the country during the summer with their own tents, equipment, speakers, and entertainers, making three-day or one-week stands in communities which signed up in advance. Many prominent politicians found the circuit chautauqua a convenient vehicle for campaigning, and all but the crassest programs doubtless brought a good deal of cultural stimulation to small communities whose isolation was great in the days before the motion picture, the automobile, and the radio. These inventions doomed the old-time local chautauquas. Their heyday came just before World War I, decline was rapid in the 1920's, and the depression of 1929 seems to have wiped out the last of the circuits.

Chautauqua Institution, however, has adapted itself with remarkable resilience to changing social forces. Its program has always been and continues to be alive to major contemporary issues. The depression brought serious financial problems (including a temporary receivership in 1933), but these were solved without interruption of any part of its program. Chautauqua emerged from the crisis of the 1930's in a stronger position than before, with all obligations met and a substantial new endowment.

That Chautauqua has maintained a position of leadership in public opinion and adult education throughout 80 years of rapid change is evidence of the creative thinking of the men who have directed its activities. The two founders guided the movement during its formative period, and brought into association with them such distinguished educators as Dr. William Rainey Harper, who was principal of the Chautauqua Summer Schools, 1887-1898, and who incorporated many ideas derived from Chautauqua into the structure of the new University of Chicago where he became its first president in 1891. He was succeeded as principal of instruction by Dr. George E. Vincent, son of one of the founders, who was president of Chautauqua Institution from 1907 until 1915, when his duties as president of the University of Minnesota and later of the Rockefeller Foundation compelled him to retire from the active leadership of Chautauqua. His successor, Dr. Arthur E. Bestor, became associated with the Institution in 1905, and was its president from 1915 until his death in 1944. His administration, spanning two world wars and a great depression, carried Chautauqua through perhaps its most critical period of readjustment and re-evaluation, and insured its continued pre-eminence as a forum of public discussion and a center of cultural activity in the mid-20th century. Since his death the program has been under the direction of Ralph McCallister.

Part of the strength of Chautauqua lies in the fact that it is a community as well as an educational institution. Though the permanent population is small, some 8,000 to 10,000 persons make Chautauqua, N. Y., their summer home, and approximately 40,000 attend some part of the season's program. Chautauqua Institution is incorporated by special act of the New York state legislature as a non-profit educational institution under a board of trustees. The Institution conducts the program of lectures, music, and school; with funds derived from admission charges at the gate, school registration fees, endowment, and miscellaneous income. It also maintains the edu-

cational plant and furnishes many of the municipal services of the community.

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ARTHUR E. BESTOR, JR.,
Professor of History, University of Illinois.

CHAUTEMPS, shō-tàn', Camille, French political leader: b. Paris, France, Feb. 1, 1885. Leader of the Radical Socialists, he was minister of the interior in 1924 and of justice 1925-26, and in February 1930 became premier of France, a position he was to hold twice more during the stormy years leading up to World War II. After serving as minister of public instruction (1931) and of the interior (1932-1933) he again became premier, serving from November 1933 to January 1934. He was minister of public works during the first half of 1936, then minister of state (1936-1937) in the first government of Léon Blum, and, for the third time, premier (June 1937 to March 1938). He resigned upon Germany's annexation of Austria, but continued as vice premier until June 1940, serving in the cabinets of Édouard Daladier and Paul Reynaud.

Following the collapse of France, Chautemps sided with Marshal Henri Philippe Pétain, served in his cabinet, and represented the Vichy government on a secret mission to the United States in November 1940. At the end of the war the French High Court tried him in absentia, convicted him of collaboration, and in March 1947 sentenced him to five years in prison. In April 1954—the statute of limitations having voided his sentence—he returned to Paris after 14 years in the United States.

CHAUVEAU, shō-vō', Pierre Joseph Olivier, Canadian politician and writer: b. Quebec, Canada, May 30, 1820; d. there, April 4, 1890. Educated at Quebec Seminary, he was called to the bar in 1841, becoming a Queen's Counsel in 1853. He entered Parliament in 1844 and held portfolios in the government until 1855 when he was appointed chief superintendent of public instruction for Lower Canada. In 1857 he founded the *Journal of Public Instruction* (also published in French). He was first premier of the Province of Quebec under the Confederation (1867-1873), and speaker of the Senate (1873-1874). In 1878 he became professor of Roman law at Laval University, Montreal, later dean of the law faculty.

CHAUVEAU-LAGARDE, -là-gård', Claude François, French advocate: b. Chartres, France, 1756; d. Paris, 1841. During the French Revolution he became celebrated for his eloquent defense of those on trial in the Reign of Terror, when he was himself imprisoned for a short time. He was the advocate of Marie Antoinette and of Charlotte Corday at their trials. He defended Jacques Pierre Brissot and Madame Elizabeth of France; his defense of the Venezuelan general

Francisco Miranda saved him from the scaffold. In 1814 he was ennobled by the government of the Restoration, and in 1828 appointed counselor to the Court of Cassation.

CHAUVINISM, shō'vîn-iz'm, a word derived from Nicolas Chauvin, a soldier of the French Republic and the First Empire. His excessive admiration for Napoleon made him an object of ridicule among his comrades, so that the word coined from his name became a synonym for those who show exaggerated devotion to any extreme form of patriotism. A vaudeville piece, *La cocarde tricolore* (1831), in which there was a character named Chauvin and a song that became immensely popular, fixed the word in the French language. It is now used not only in French but in English and other languages to express over-intense nationalism such as jingoism.

CHAVASSE, shā-vās', Francis James, Church of England prelate: b. Sutton Coldfield, England, Sept. 27, 1846; d. Oxford, March 11, 1928. Educated at Corpus Christi College, Oxford, he was ordained in 1870. As bishop of Liverpool from 1900 to 1923, he is best remembered for his services in starting construction of Liverpool Cathedral, designed by Sir Giles Gilbert Scott.

CHAVES, shā'vēsh (Lat. AQUAE FLAVIAE), town, northern Portugal, in the Vila Real district of Trás-os-Montes e Alto Douro Province, on the Tâmega River 22 miles north-northeast of Vila Real. Its name means "keys." It is a center for agricultural trade, and manufactures textiles, chocolates, and ceramics. Its hot mineral springs gave it the ancient Roman name. Situated eight miles from the Spanish border, it figured frequently in conflicts between the two countries. Changing hands many times down the centuries, it played a part in the Peninsular War when Napoleon's Marshal Nicolas Jean de Dieu Soult captured it March 12, 1809. It was often used as a meeting place to settle disputes, notably on Sept. 18, 1837, when the monarchists and liberals met at the Convention of Chaves. Pop. (1940) 8,706.

CHAVEZ, chā'vās, Carlos, Mexican orchestral director and composer: b. Mexico City, June 13, 1899. Except for piano lessons from his brother Manuel and a few lessons later from Mexican teachers, he was largely self-taught, learning from books and from the music of European masters. He traveled in Germany, France, and the United States, broadening his horizon. His first work incorporating Mexican folk music was a ballet, *The New Fire* (1921), commissioned by the secretary of education. In 1928 he founded the National Symphony Orchestra of Mexico City and became director of the National Conservatory of Music, and in 1933 headed the Department of Fine Arts, where he used his influence to encourage native composers to use Indian sources for their music. In 1931 his *Energía* was played at a Pan American concert in Paris. The following year his ballet-symphony *H.P.* (horsepower) with stage design by Diego Rivera was produced by the Philadelphia Grand Opera Company directed by Leopold Stokowski. *Sinfonia India* was first heard over the Columbia Broadcasting System in 1936. It employed Indian instruments seldom heard in symphonic music. He

visited the United States many times as guest conductor of leading orchestras. In 1938 he received a Guggenheim fellowship. The *Concerto for Four Horns* and the piano concerto (first heard in New York in 1942) gave evidence that Chávez was a craftsman of high musical intelligence who succeeded in incorporating new forms into common speech while giving lofty expression to the musical ideology of his people. His views on music are given in his book *Toward a New Music* (Eng. tr., New York 1937).

CHAY, chā, or **CHOY**, the root of a small plant, common in Hindustan, which yields a durable red dye.

CHAYOTE. See **SECHIUM**.

CHAZYAN, in *geology* the second series of the Ordovician System of North America, succeeding the Canadian and underlying the Bolarian or Lower Mohawkian. This series is named after Chazy, a town in northeastern New York State where there are about 1,000 feet of fossiliferous limestone; equivalent shales have Llanvirnian and Llandeilan graptolites. See also **ORDOVICIAN**.

CHEAPSIDE, historical London district and street of London, England, extending eastward from St. Paul's Cathedral to Poultry, and thence to the Mansion House. In the Middle Ages the Chepe (from the Anglo-Saxon word *ceap*, sale or bargain) was an open square where markets and fairs were held, and executions occasionally took place. In this section were two of the Eleanor Crosses (q.v.), and here also stood the famous Mermaid Tavern, convivial gathering place of William Shakespeare, Ben Jonson, and other poets and dramatists of their day. John Milton was born in this area. After the Great Fire of 1666, the square was narrowed down to one street. During World War II Cheapside was heavily bombed.

CHEAT, chēt, river, rising in the Allegheny Mountains in West Virginia, and after the union of its forks flowing north and northwest into the Monongahela River at Point Marion, a few miles over the Pennsylvania border. About 75 miles long, it is a source of hydroelectric power, being dammed in its lower course to form the 10-mile-long Cheat Lake, or Lake Lynn. At the West Virginia end the river has carved a gorge with walls 1,000 feet high, a scenic area made part of the Coopers Rock State Forest.

CHEAT. See **BROME GRASS**.

CHEATHAM, chēt'ām, Kitty (in full **CATHERINE SMILEY BUGGE**), American soprano: b. Nashville, Tenn., 1864?; d. Greenwich, Conn., Jan. 5, 1946. She studied music in France and Germany and was the first singer to introduce Negro songs to Europe. An interpreter of the literature and songs of childhood, she appeared in concert halls throughout the United States and Europe with a repertoire that included more than 1,000 songs in nine languages, with special emphasis on the works of American composers.

CHEB, kěp (Ger. **EGER**), town, Czechoslovakia, in the Province of Bohemia, on the Ohře River, 90 miles west of Prague (Czech **PRAHA**), near the German border. A rail junction and

industrial center, it manufactures motorcycles, bicycles, agricultural machinery, textiles, leather, and beer. Peat is cut nearby. The Austrian general Albrecht von Wallenstein, prince of Sagan, was assassinated here in 1634. In 1933 the majority of the German population began to leave, anticipating trouble, and after World War II the remainder were sent away. Pop. (1947) 14,533.

CHEBOYGAN, shē-boi'gān (an Indian name meaning "place of entrance"), city, Michigan, seat of Cheboygan County. At an altitude of 600 feet, it lies at the mouth of the Cheboygan River on the South Channel of the Strait of Mackinac on Lake Huron. It has an airport. Once an important lumbering center, it now manufactures paper and other wood products, snow plows and tools. Having excellent port facilities, it ships fish and agricultural products. A leading summer and winter resort, it is headquarters for fishermen, and here begins an inland water route by canoe, much used by sportsmen. Pop. (1950) 5,687.

CHECHEN-INGUSH, chī-chēn'in-gōōsh', former Autonomous Soviet Socialist Republic, formed in 1920 of two autonomous oblasts within the Russian Soviet Federated Socialist Republic. The Chechen-Ingush ASSR occupied 6,100 square miles on the north slopes of the Caucasus. The area is rich in oil and timber, Grozny, its chief city, being one of the principal oil-producing centers of the USSR. Population in 1941 was estimated at 732,838, about 55 per cent Chechen and 10 per cent Ingush, both groups of Mohammedan religion. For generations the Chechen people had fought the Russians fiercely, especially in the struggles led by Shamyl (q.v.) or Shamil during the first half of the 19th century. In 1944 the Soviet government dissolved the Chechen-Ingush ASSR, on the ground that many Chechens had collaborated with the German invaders in World War II and had set up saboteur groups in the rear of the Soviet troops. As a result the population was resettled in other districts of the Soviet Union.

CHECK. See **COMMERCIAL PAPER**.

CHECKERBERRY. See **GAULTHERIA**.

CHECKERED BEETLE, any member of the Coleopterous family Cleridae, which are often marked or checked with red, yellow, and other shades and often with the dark portions metallic bluish-green, or purple. The larvae are predaceous, free running. They are found in the soil in the nests of bees and wasps and in the egg capsules of grasshoppers; above ground in the nests of bees and wasps, and under bark where they feed upon boring insects. The adults are also predaceous and are particularly beneficial in destroying bark beetles (q.v.). Some species visit flowers to feed upon pollen and nectar.

CHECKERS or **DRAUGHTS**, drafts, a game for two opponents, played upon a square board marked in 64 small squares of alternating colors in 8 rows of 8 each. Each contestant has 12 checkers at the beginning, all of them governed in their moves by the same rights and restrictions. Because of the points of similarity and difference between checkers and chess (q.v.), the

two games are often compared. There are conflicting boasts about the age of the two games and the number of players of each. Some authorities on checkers hold that their game requires so much less original explanation that it may have lived a long time before chess was developed into approximately its modern form. Some insist checkers is over 5,000 years old.

Though checker partisans maintain that there are many more players of their game than of chess, they admit that claim may be justified only by counting the players of variants from the form best known in America, Britain, and France such as Spanish draughts, Polish draughts, Italian draughts, German draughts, Turkish draughts, and other games, each with somewhat different rules from American checkers.

What Americans think of as American checkers and the British call English draughts, played throughout the English-speaking world, has by far the largest number of players among the various forms of checkers. As in other forms of the game, all of the play is on half the squares of the board, usually the darker squares. The board is so placed that a single black square is in the corner at the left of each contestant. For greater ease in recording moves, reporting games, and presenting problems, standard diagrams of the board reverse the color scheme, making it possible to use type in numbering the squares as in the accompanying diagram.

BLACK			
1	2	3	4
5	6	7	8
9	10	11	12
13	14	15	16
17	18	19	20
21	22	23	24
25	26	27	28
29	30	31	32
WHITE			

The checkers, in the form of disks a bit smaller than the squares, are placed on the squares numbered from 1 to 12 inclusive for the player of the Black or darker men, and on those numbered 13 to 32 for the player of the White or lighter men. Black always moves first, and thereafter the players alternate. All moves are diagonal, and all of just one square except when capturing an opposing piece or pieces. Whenever a man reaches the "king row"—the row farthest from where it began—it is crowned by placing another checker of the same color on top of it. In subsequent moves, such a man, called a "king," may jump forward or backward or in a series combining both directions, or make plain moves in either direction; whereas a man that is not a king may move only forward, or away from its player. Whenever a player is able to jump one of his men over an opposing man on the diagonally adjoining square onto an unoccupied square, he must do so, thus capturing the jumped man, which is then removed from the board. It is possible, in certain positions, for a man to jump a series of opposing men, the maximum possible being 9 by a king, though this seldom occurs. If a player is in position to jump in more than

one direction with more than one of his men, he may choose any jump or series of jumps he prefers, regardless of which will jump the larger number of men in series, but he must complete the available series of jumps in the path he selects. If a player fails to jump, when able to, and attempts a plain move instead, he is required under the laws of the American Checker Federation to take back the plain move, and jump. When a plain man jumps into the king row and is crowned, its move ends there; it may not on the same move jump another piece. The objective of the game is to produce a situation in which it is impossible for one's opponent to make a move, usually because all his men have been captured or cornered. A draw results when it develops that neither side can force a win. Among ranking players there are many draws, among lesser, few.

Perhaps half of all checker games are for the casual recreation of the participants, the overwhelming majority of these, people who have never read a book on the game or made a serious study of it. The better players are as deep students as those of any other intellectual pastime, and the literature of the game is rich in guidance as to opening series of moves, general mid-game strategy and end-game tactics, besides special treatises on maneuvers which experts call traps, tricks, and shots; collections of problems, and compendiums of records of famous games.

Tournament and match play competitions on a national basis have been conducted in England and Scotland for nearly two centuries. Such formal events in or between clubs, schools, and other organizations have been numerous in the United States, where the first national championship was played in Boston in 1905. In the early 1950's, under the auspices of the American Checker Federation, there were four recognized world championships at match play, all of them held by Americans, each of them subject to a challenge match every two years. Tom Wiswell, of Brooklyn, N. Y., won that based on the straight game of checkers, called the world "go-as-you-please" championship, defeating a fellow Brooklynite, Millard Hopper, in 1951. The "three-move" world championship was successfully defended in the same year by Walter Hellman, of Gary, Ind., against Maurice Chamblee of Birmingham, Ala.; in this event the first two moves of Black and the first of White are prescribed for each game, these obligatory moves being determined in advance by ballot. A similar event, the "two-move" championship, was won in 1952 by Marion Tinsley of Columbus, Ohio, over Newell Banks of Detroit, Mich., known as "the grand old man of checkers," who holds the "blindfold" championship and has been a champion at various forms of checkers for many years.

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SHEPARD BARCLAY.

CHECKOFF, a practice whereby an employer by agreement with a union withholds from members' pay their dues, fees, and assessments, and transmits funds withheld to the union. The Taft-Hartley Labor Act required that before an employer might withhold funds from wages, each employee must authorize the checkoff by written

assignment, irrevocable for one year or until the contract expires, whichever is shorter. If an "escape period" is provided, checkoff authorizations may be renewed automatically from year to year. A Bureau of Labor Statistics survey of 1,653 contracts (covering 5.5 million workers) in 1952 revealed that 71 per cent provided the checkoff, 31 per cent covered initiation fees as well as dues, and 20 per cent also included checkoff of assessments. The checkoff was found in nine tenths of the agreements having no union shop or maintenance-of-membership, but only in slightly over 60 per cent of those granting union security; it was found in over 90 per cent of Congress of Industrial Organizations (CIO) and independent union contracts but in only 50 per cent of American Federation of Labor (AFL) agreements. All contracts studied in the communications industry had checkoff clauses but few had union security; in the construction industry, the opposite was found to prevail.

JOHN NEWTON THURBER,

Formerly, United States Department of Labor.

CHECKS AND BALANCES, a term signifying the method adopted by the framers of the Constitution of the United States to separate the powers of government so as to prevent the encroachment by one branch upon the domains of the others. Hence in organizing the national government, the Constitution provided that all bills, before becoming laws, must be passed by both branches of Congress, thereby in effect giving each house the right to veto or disapprove the acts of the other. Thus were the House of Representatives and the Senate balanced against each other. However, the Constitution further provides that before a bill passed by the Congress can become a law it must be submitted to the president who must either sign (approve) it or return it to the House in which it originated together with a statement of his objections. Thereafter the Congress may repass the bill by a two-thirds vote of each house, in which event it becomes a law just as though it bore the president's signature. This is what is known in parliamentary language as "overriding the president's veto." The veto power is the president's check upon Congress, and the right to pass a measure over the veto (but only by a two-thirds majority) is Congress' check on the president.

Again the judicial department is balanced against both the executive and the legislative by the power it has assumed of refusing to sanction the acts of either when it regards such acts as having been done without authority, that is, in contravention of the Constitution. The legislature is balanced against both the judiciary and the executive by giving it the right to impeach and remove executive and judicial officers from office for high crimes and misdemeanors. The Senate is balanced against the executive by requiring its approval of treaties negotiated at the behest of the president, and also by requiring its consent to most if not all executive appointments such as ambassadors, ministers, consuls, judges of the Supreme Court, and numerous others. Treaties require approval by two thirds of the Senate to become effective. Many other examples of checks and balances might be given. State constitutions have followed the example of the national Constitution in providing checks and balances in the conduct of the internal affairs of states.

CHECKS AND DRAFTS. A check is the simplest form of bank draft; that is, a check is a written order by a bank's customer to pay a specified amount of money from the customer's checking (demand) account to a designated third party. A bank draft may be defined as an official check drawn by a bank against funds it has on deposit with another bank, or an arrangement made between the buyer and seller of goods and services for payment of an agreed amount on delivery or performance.

For example: a flour mill in Buffalo, N. Y., buying wheat from an elevator company in Kansas, agrees to pay for the wheat on delivery. When the seller ships the wheat, he draws a draft on the Buffalo flour mill for the agreed amount; and after attaching the railroad bills of lading to it, takes it to his own Kansas bank for collection. The Kansas bank forwards the draft with attached bills of lading to a bank in Buffalo. The collection department presents the draft to the flour mill and when payment is made delivers the draft and bills of lading to the flour mill. The money collected, except for a small collection fee, is sent to the Kansas elevator firm. This is only one illustration of the uses made of drafts in business transactions.

A simple illustration of the use of checks would be: John Doe has \$150 on deposit in a checking account at the State Central Bank, a sum which he desires to use for the purchase of a washing machine from the Home Appliance Store. He buys the machine for \$125 and draws a check or order for his bank to pay the store that amount from his account. The appliance store may not be a customer of the State Central Bank but may deposit John Doe's check at the Town National Bank, through the local clearing house; and the check is delivered to the State Central Bank where \$125 is deducted from the account of John Doe.

A check written on an account in a city or town anywhere in the United States can be paid in any other part of the United States and many foreign countries. It will be returned to the bank on which it is drawn, through a remarkably efficient check-collecting service maintained by the Federal Reserve System.

The committee on collections of the Federal Reserve System and the American Bankers Association have cooperated for many years in a program to improve the efficiency of the countrywide collection of checks. One step in that program was taken in 1910, when all banks in the United States were numbered to indicate their name and location. This is a hyphenated symbol, as "2-1." The figure 2 would show the bank is located in the central reserve city of Chicago, and the 1 would identify the First National Bank of Chicago.

Another step in this program was taken in 1949, when a check-routing symbol was assigned to each bank whose checks are collectible through the Federal Reserve System. This routing symbol appears with the transit number, and the combined symbol is printed in the form of a fraction in the upper right hand corner of checks, just above the figure amount line. For example: 55-14611-2-4.

The denominator or the lower figure is the routing symbol, composed of three or four digits without spacing. The first digit (or two in the case of Kansas City, Dallas, and San Francisco) designates the Federal Reserve dis-

trict in which the bank is located. The second digit designates the Federal Reserve bank or branch serving the drawee bank. The third digit indicates the number of days that elapse before the item can be cleared and presented for payment at the drawee bank.

Checks are useful in making all kinds of payments, because they can be transferred from one party to another like money. The payee of a check transfers ownership by writing his name on the back of the check exactly as it appears on the face. By endorsements, checks may pass through several hands before being finally paid at the bank on which they are drawn. The three most common forms of endorsement are: blank endorsement, which consists of the signature of the endorser only, as "John Brown"; a special endorsement specifying the name of the person or firm to whom the check is being transferred as:

Pay to the order of
William Green
John Brown;

a restrictive endorsement preventing further transfer of a check by specifying the only purpose for which the check can be used; for example:

Pay to the order of
State Central Bank
For Deposit only
John Brown.

A check is usually about $8\frac{1}{4}$ inches by $3\frac{1}{8}$ inches and a common arrangement is:

FARMERS AND MERCHANTS STATE BANK		NO. _____
NEWTON, MASS. _____ 19 _____		PS-1378 1041
Pay to the order of _____		\$ _____
_____ DOLLARS		

Here are some suggestions on how to write checks correctly:

(1) The *date* should be written first, and it should be the date on which the check is drawn. If you must make out a check on a Sunday or holiday, date it the previous business day, as checks dated on Sundays or holidays may not be valid in some states. Never write a future date.

(2) The *payee's name* should be written after the printed words "Pay To The Order Of." (The payee is the person or organization to whom the money is to be paid.) Spell the name correctly.

(3) The *amount in words* should be started as far to the left as possible so that no one may insert a word before it and thereby raise the amount. Fill in any unused space with a line.

(4) The *amount in figures* should be written close to the \$ sign, and must agree with the amount in words. If there is a difference between them, the amount in words fixes the amount of the check.

(5) Your *signature* should be written only after all of the other items have been carefully written. Never cross out or change any written part of a check. If you make an error, write "Canceled" across the face of the check and file it with your canceled checks.

A *certified check* is one stamped "Certified" by a bank after it has set aside the required funds from the check drawer's account. The bank thus

certifies or guarantees that the amount of the check will be available when the check is presented for payment.

CHEDDAR, chéd'ēr, village, England, in northern Somersetshire, 22 miles southwest of Bristol at the foot of the Mendip Hills. Renowned since the 17th century for its cheese, the name of which has been copied for similar cheeses in other parts of the world, it lies in a dairying region and is an agricultural center. It is tourist headquarters for visitors to the Cheddar Gorge, a picturesque pass over 400 feet high and two miles long, with limestone walls having famous stalactite caves. Pop. (1931) 2,154.

CHEDORLAOMER, kéd-ör-lā-ō'mēr (also CHEDOR-LAOMER; CHODORLAHOMOR), a Biblical king of Elam. As told in Genesis 14:1-16, Chedorlaomer, with his allies Amraphel, king of Shinar; Arioch, king of Ellasar, and Tidal, "king of the nations," warred upon the cities in the plain of the Jordan, holding them in subjection for 12 years, when they revolted. After ravaging the countryside and winning a battle in the vale of Siddim, he sacked Sodom and Gomorrah and captured Lot, Abraham's nephew. Abraham then pursued and slew Chedorlaomer and his cohorts, setting Lot free.

CHEDUBA, chē-dōō'bā or chéd'ōō-bā, island, Burma, about 20 miles off the coast of Arakan in the Bay of Bengal, in the Kyaukpyu district, separated by Cheduba Strait from Ramree Island, which is between it and the mainland. Its area is 220 square miles. A port and village of the same name is on the northeast coast. Cattle raising and agriculture are followed on Cheduba, and there are oil deposits. The island was held by the Japanese from May 1942 to January 1945. Pop. (1939 est.) 30,000.

CHEERYBLE BROTHERS, the twin brothers, Edward and Charles Cheeryble, in Charles Dickens' novel *Nicholas Nickleby* (q.v.). They are the liberal benefactors not only of Nicholas but also of all with whom they came in contact. Dickens patterned them on William and David Grant, cotton manufacturers of Manchester, England.

CHEESE AND CHEESE MAKING.

Cheese is the concentrated food product obtained by coagulating milk, stirring and heating or cooking the curd, draining off the whey, and collecting or pressing the solid or semisolid curd. The coagulation or curdling is accomplished usually by the enzyme action of rennet or pepsin and less frequently by bacterial souring, or by a combination of both. The name "cheese" alone, unqualified, in the United States connotes the commonest variety, called American cheese, and in England, Cheddar cheese. Most cheese is made from the milk of cows, and smaller quantities from that of goats and sheep. It has also been made in a primitive way from the milk of camels, asses, mares, buffaloes, reindeer, and other animals. The taste or flavor of cheese depends not only upon the kind of milk but also upon the process used.

Historical.—The exact origin of cheese making is unknown. According to an ancient legend, cheese was first discovered accidentally when an Arabian merchant, setting out on a long day's

journey across the desert, put his supply of milk into a pouch made of a sheep's stomach. The heat of the journey and the rennet in the lining of the pouch caused the milk to separate into liquid whey and solid curd. Though not understanding the transformation, he found at nightfall that the whey satisfied his thirst and the cheese satisfied his hunger and had a delightful flavor. Thus the manufacture of one of our most useful foods was begun.

Cheese is recorded as having been made and eaten in Biblical times. It is known to have been used as a food 2,000 years before Christ. It is believed that Asiatic travelers brought the art of cheese making to Europe. Cheese making flourished in many parts of the Roman Empire at its height, and the art was brought to England by the Romans. During the Middle Ages, or from the decline of the Roman Empire until the discovery of America, as well as later, the art of cheese making was carried on and improved by the monks in the monasteries of Europe. The origin of Gorgonzola cheese in the Po Valley in Italy dates back to 879 A.D., and Italy was the most advanced cheese-making center of Europe as early as the 10th century. Roquefort cheese was first mentioned in the ancient records of the monastery at Conques, France, in 1070. Cheese was included in the ship's supplies when the *Mayflower* made its famous voyage to America in 1620.

Prior to the middle of the 19th century, cheese making was strictly a local farm industry, carried on mostly by housewives in farm homes. The first cheese factory in the United States was started in 1851 near Rome, Oneida County, N. Y., by Jesse Williams, and the first cheese factory in England was started in 1870 at Derby. Herkimer County, adjoining Oneida County, was a center of the cheese industry from 1851 to about 1900. For 30 years, beginning in 1861, the market at Little Falls, N. Y. was the largest cheese market in the world. Beside farm-made cheese, the product of about 200 factories was sold there. With the increase in population and demand for market milk, the industry gradually moved westward, centering in the rich farm lands of Wisconsin. Cheese making in the United States and in the other leading cheese-producing countries is now largely a factory industry, only small amounts being made on farms for home use.

Varieties.—A survey of the English, Italian, German, and French literature on cheese making, by the writer, has revealed names and descriptions of 390 kinds of cheese. The list is obviously incomplete, and it is safe to say that there are more than 400 names given to cheeses. Most of these are of only local significance, named usually after the town or locality where they originated or are produced, and are modifications or variants of more widely known varieties. Actually there are about 20 distinct varieties or groups, of which the following are the best-known names: Brick and Muenster; Brie; Caciocavallo, including Provolone; Camembert; Cheddar; Cottage; Cream; Edam; Emmentaler and Swiss; Gouda; Hand; Limburger; Neufchâtel; Parmesan; Process; Romano; Roquefort and Gorgonzola (blue cheeses); Sapsago; Trappist; and whey-albumin cheeses, including Primost and Ricotta.

Classification.—The varieties of natural (non-processed) cheese can be classified conveniently on the basis of body characteristics and type of ripening. Examples are given in the following

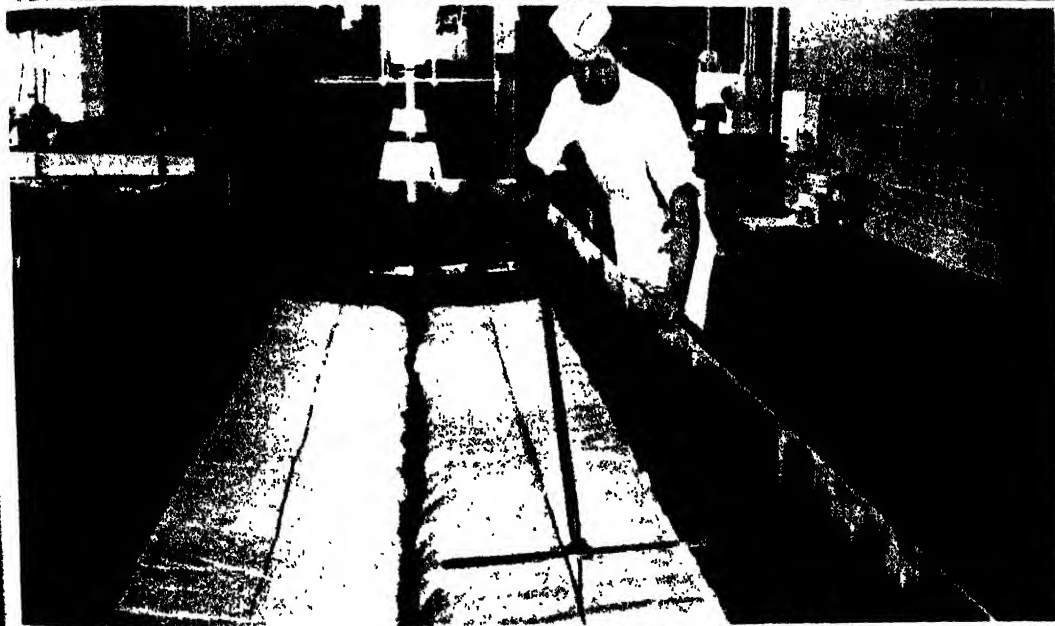
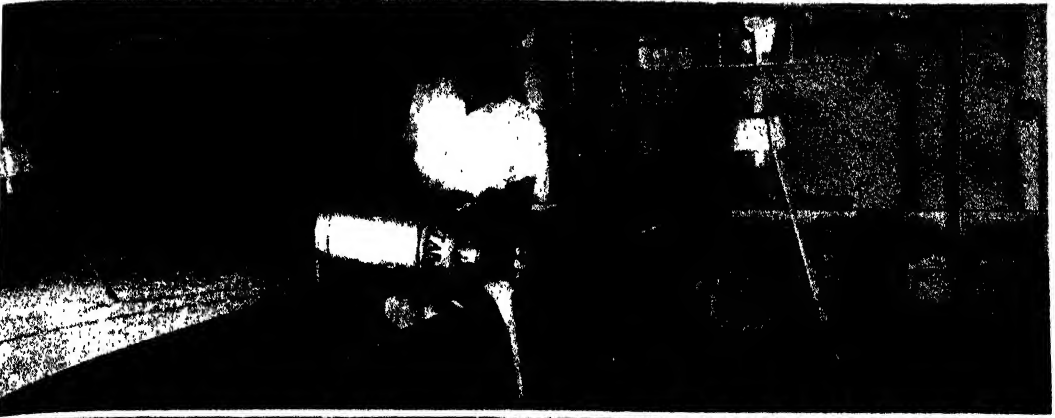
classification: (1) Very hard, ripened by bacteria: grating cheeses—Parmesan, Romano, Asiago old, Sapsago, Sbrinza; (2) Hard, ripened by bacteria: without gas holes or eyes—Cheddar, Edam, Gouda, Caciocavallo, Provolone; with eyes—Emmentaler, Swiss, Gruyère; (3) Semi-soft: ripened by bacteria and surface microorganisms—Limburger, Port du Salut, Trappist; ripened principally by bacteria—Brick, Muenster, Gold-N-Rich, Chantelle; ripened by blue mold in the interior—Roquefort, Gorgonzola, Blue, French Bleu, Stilton, Wensleydale; (4) Soft: ripened by bacteria and surface microorganisms—Bel Paese, Brie, Camembert, Cook, Hand, Liederkranz, French Neufchâtel; unripened—Cottage, Pot, Baker's, Cream, American Neufchâtel, Primost, moist Ricotta.

Manufacture.—The manufacturing procedure used generally, with some of the specific modifications for individual varieties, is described as follows: The milk of cows, produced in the evening and morning, may be strained and is poured promptly into milk cans and cooled by running it over a cooler or by placing the cans in cold, running water. It is delivered early in the morning, while still sweet, to the cheese factory. Here it is graded and weighed, inferior lots are rejected, samples are taken for butterfat tests and frequently for quality tests, and it is pumped to a receiving tank.

The milk usually is pasteurized. For Swiss cheese it always is clarified, that is, run through a high-speed, centrifugal clarifier, which removes dust and other particles and greatly improves the formation of gas holes, known as eyes, that form in the cheese as it ripens. Clarification of the milk also reduces "pin-hole" gassy formation in Cheddar and other types of cheese, improving the texture and body or mellowness.

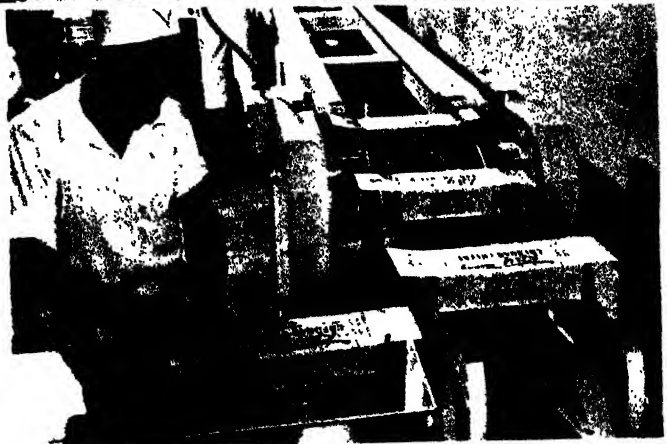
The milk is conveyed from the pasteurizer or clarifier to the cheese vat or kettle. Most vats are rectangular. Cheddar vats may hold as much as 15,000 or as little as 500 pounds of milk. Swiss cheese is made in round, copper kettles holding 2,000 to 3,000 pounds. The vat or kettle is made with a steam jacket for heating the milk. Milk for some kinds of cheese may be standardized, that is, a small proportion of the fat is removed as cream, by means of a mechanical separator, to adjust the composition uniformly. For Swiss cheese about 10 per cent of the fat is removed. In some places removal of fat from milk used in making Cheddar cheese is illegal. The cream removed is either sold as market cream or churned into butter. Some cheese-makers test the rennet-coagulation property of a sample of milk from each vat by means of a rennet test—adding a definite proportion of rennet extract and noting the time required for the rennet to coagulate or curdle the milk sample by its action on the casein. If the milk curdles too slowly, calcium chloride may be added, in a proportion of not more than 0.02 per cent, to aid curdling. To increase the yellow color, a harmless, vegetable coloring extract known as annatto may be added to the cheese milk.

The temperature of the milk is adjusted to a definite point in the range of 86° to 91°F. A bacterial culture, known as a starter, is added. The starter for most kinds of cheese is a mixed culture containing several types of harmless bacteria, which convert the milk sugar or lactose into lactic acid and also aid in the ripening. The production of acid by the proper bacteria helps

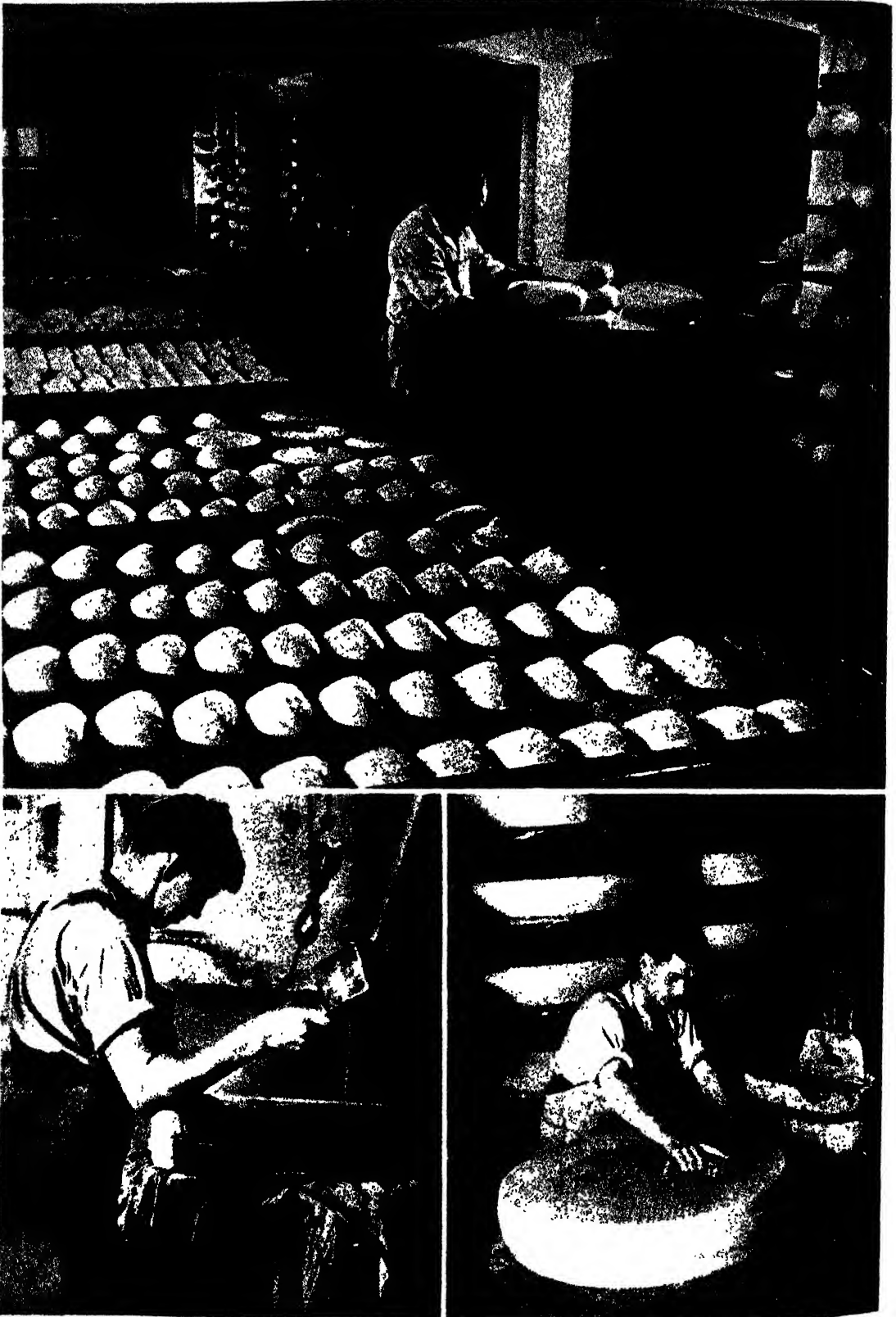


CHEESE AND CHEESE-MAKING

Top to bottom: (1) The young man pours the initial culture from the can labeled "Starter" into a vat of milk. (2) The cutting of the thickened curd. (3) The curd is allowed to drain sufficiently and to mat. According to variety, cheeses may be put under various kinds of pressure during these processes. (4) The cheese is packaged on an assembly line for distribution.



CHEESE AND CHEESE-MAKING



(Top) Netherlands Information Service; (others) Switzerland Cheese Association

Top: Cheeses are soaked in brine tanks in order to form a natural rind before they are stored for curing. Note the round Edam cheeses on shelves in foreground. Left: Tightening the cheese form, a step in the making of Switzerland Cheese. Right: While Switzerland Cheese is being cured the daily washing in the curing cellar is an all-important function. Observe the thoroughness with which each cheese is scrubbed with a brush.

to drain the whey from the curd, helps to "knit" the curd compactly, retards the growth of gas-forming and off-flavor-producing bacteria, and improves the flavor. The use of a starter is very necessary. For Swiss cheese two or sometimes three separate starter cultures are added. The milk may be allowed to ripen and then it is "set" with a small quantity of rennet—usually three ounces of liquid rennet extract per 1,000 pounds of milk—to curdle it.

Usually about 30 minutes after setting, the curd is cut into small pieces. It gradually is stirred and warmed and, after it is sufficiently firm, the whey is drained off or the curd is dipped out. The volume of whey usually comprises 86 to 90 per cent of the volume of the milk. It contains 0.3 to 0.35 per cent of fat in the case of that from Cheddar cheese, or as much as 0.75 per cent in that from Swiss cheese. The whey is separated and the resulting whey cream is used in making butter. The fat-free whey contains nearly one half of the percentage of solids—principally lactose and milk salts or minerals—of the original milk. It usually is fed to livestock, but recently it is being utilized more efficiently as a source of lactose and as concentrated or dried whey solids for many types of human food.

After sufficient draining, the curd may be salted. Cheddar cheese curd is first allowed to mat and then is run through a curd mill and cut into small pieces, after which salt is mixed with it. The curd is placed in hoops or forms, which usually are lined with cloth, and usually is put under pressure overnight. Some types, such as Cottage and Cream cheese, are not pressed but merely allowed to drain in cloths, and hence contain a relatively large percentage of moisture. Some are allowed to settle in perforated forms and are inverted periodically but not pressed, as in the cases of Blue and Brick cheeses. Some hard cheeses, such as Swiss, Parmesan, Romano, and Provolone, are not salted during the draining and firming stage but are immersed later in salt brine. Some softer kinds, such as Blue and Brick cheeses, are salted by rubbing dry salt on the surface during the first week of curing.

The cheese is ripened or cured on shelves and kept clean, in special curing rooms at a temperature usually between 45° and 60°F., or as high as 72°F. in the case of Swiss, and with the relative humidity regulated. After the usual curing, the cheese may be stored and cured more slowly at a lower temperature, as low as 35°F. At least three months' curing is required generally and some types, such as the very hard Italian cheeses, require more than a year.

No two of the principal varieties are made alike. The details of setting, cutting the curd, stirring, heating, draining, pressing, salting, and curing, as well as the adjustment of the composition of the milk and the use of bacterial starters, vary for the different types. Variations in these details determine the kind of cheese and are regulated strictly by the manufacturer in accordance with the art found most favorable for each kind of cheese. Thus, by mechanical manipulation and the use of specific ripening agents, milk is transformed into a much less perishable and more concentrated food product, which may vary in type according to the method of manufacture and the specific biological agents used.

Five thousand pounds of milk per day, or about 500 pounds of cheese, is considered a

minimum quantity for profitable production for sale.

Production.—The principal types of cheese manufactured in the United States, with figures in millions of pounds produced in 1947, are as follows: American type, including Cheddar, 931.9; Creamed Cottage, 230.6; Swiss, 71.6; Cream Cheese, 57.6; Italian varieties, principally Parmesan and Romano, 38.1; Brick and Muenster, 26.5; Blue or blue-veined, 10.6; Limburger, 7.8; full- and part-skim American type, 7.1; Neufchâtel, 4.4; and other minor types, 24.2; total of all cheeses (including Cottage and skim-milk American type), 1,410.4 million pounds.

The principal cheese-producing states in the United States, with figures in millions of pounds produced in 1947, are as follows: Wisconsin, 535.9; Illinois, 86.9; New York, 71.0; Minnesota, 58.9; Missouri, 58.7; Tennessee, 42.4; Indiana, 40.2; Ohio, 34.4; Oregon, 29.2; and Michigan, 28.1. These figures do not include skim-milk Cheddar cheese or Cottage cheese. Exclusive of those two kinds, about 45.5 per cent of all the cheese was produced in Wisconsin.

The production of cheese in the United States more than doubled since 1930. The production of varieties other than skim-milk Cheddar cheese and Cottage cheese in 1930 was approximately 500 million pounds, and the production in 1947 was approximately 1,178 million pounds. The consumption of cheese in the United States increased from 4.6 pounds per person in 1930 and 5.5 pounds per person during the 5-year period 1935-1939 to 7 pounds per person in 1947.

The above-mentioned increases in production and per capita consumption are directly attributed principally to the improvement in quality and in marketing practices as a result of modern, scientific research. By application of newer, more scientific principles of bacteriology, chemistry, physics, and economics, the cheese manufacturers, supplemented by research laboratories of the United States Department of Agriculture and of several state agricultural experiment stations, gradually have replaced the old rule-of-thumb practices with scientific methods. The art of cheese making, by which the different varieties were developed originally, is gradually being replaced by scientific procedures, and thereby the quality of the various cheeses is gradually being improved.

Composition.—The components of cheese include: proteins, of which approximately 95 per cent is casein and the rest mostly albumin; milk fat; water, retained in the form of whey; lactose or milk sugar, in solution in the whey; neutral

Variety	Moisture	Fat	Protein	Salt	Yield per cwt. of milk
	Per cent	Per cent	Per cent	Per cent	Lb.
American (Cheddar)	37	32.3	25.5	1.7	9.8-10.1
Swiss	39	28.0	28.0	1.3	7.5-8.5
Cream	51	37.0	9.0	1.2	
Italian: Parmesan and Romano	27-32	24-28	32-34	5.5	6.0-7.5
Brick	42	30.0	22.5	1.8	9.5
Muenster	43	29.0	23.5	1.8	9.8
Blue mold	41	30.5	22.0	4.5	9.5-10.0
Brie	45	29.0	21.5	1.8	12.0-14.0
Camembert	52.5	25.0	18.0	1.7	13.0-15.0
Limburger	44-47	28.0	22.0	2.0	11.0
Neufchâtel	60	23.0	13.0	1.5	15.0
Cottage: Curd	75-78	0.5	18.5	1.2	12.0-15.0
Creamed	74-77	4.5	16.0	1.0	15.0-17.0

salts and salt acids, including principally calcium lactate, lactic acid formed from the fermentation of lactose, calcium phosphate existing chiefly as the dicalcium salt, and calcium and sodium citrates; common salt or sodium chloride, added to supplement the flavor; vitamins and accessory food substances; frequently added annatto cheese color; and traces of gases, principally carbon dioxide.

Typical composition and yield data for the principal varieties of cheese made in the United States are given in the preceding table:

Nutritive Quality.—Cheese is one of our most concentrated, nutritive, and palatable foods. With the exception of butter, which contains more fat and less moisture, it is the most nutritious ready-to-eat dairy product. For high-quality, complete protein, fat, the essential minerals calcium and phosphorus, a variety of vitamins, and other nutrients from milk, it is very doubtful if there is any basic food which excels cheese.

It is an excellent dietary source of milk minerals. Cheddar cheese contains approximately 0.75 per cent of calcium and 0.5 per cent of phosphorus. Swiss cheese contains approximately 1 per cent of calcium and 0.6 per cent of phosphorus. Cheese is an excellent source of fat-soluble vitamin A, a good source of riboflavin, and a fair source of thiamin and of niacin. It is also a very useful source of a material which either supplies the recently isolated vitamin B₁₂ or functions like this vitamin in being a potent growth stimulant in the normal mammal and in determining the capacity of an animal to utilize protein.

Ripening.—The ripening of cheese involves changes in the protein, principally casein, from an insoluble to a soluble and more readily assimilable form, yielding "break-down" products which are classified as proteoses (caseoses and albumoses), peptones, amino acids, and ammonia. It involves also hydrolysis or splitting of the lactic acid and lactates to yield volatile fatty acids. In some cheeses milk fat is hydrolyzed or broken down and yields fatty acids. These acids, which produce sharp flavors, are break-down products not only of carbohydrates and fats but also of proteins. The ripening changes occur slowly, their rates depending largely upon temperature and moisture content. They take place after the lactose present in the cheese has been converted to lactic acid and calcium lactate by microorganisms and enzymes. The lactic-acid fermentation and the subsequent ripening changes occurring in the protein, fat, and carbohydrate by the action of microorganisms and enzymes are the causes of the sharp, piquant flavors which occur in ripened cheeses.

The enzymes which take part in ripening and the production of flavor include: lactases, proteases, and lipases, which are produced by microorganisms; galactase, which is present in the milk; and rennin, which is the principal enzyme in rennet extract. The milk-coagulating and protein-digesting activity of rennin is similar to that of pepsin, which is normally a stomach enzyme and which may be present also in rennet extract. The cheese-ripening activities of these enzymes are dependent upon the presence of the acid produced in the preliminary, bacterial, lactic-acid fermentation.

The ripening changes in cheese may be looked upon as a predigestive process, whereby the milk casein and other colloidal constituents are ren-

dered more easily digestible and assimilable in the digestive tract when cheese is eaten.

Pasteurization.—Pasteurization of milk for use in cheese is probably the most important recent advance in cheese making. In this process the milk is heated to at least 160°F. and held at that temperature for at least 15 seconds, or to at least 143°F. for at least 30 minutes, and then cooled. The heat kills any disease-producing microorganisms which may be present, thus ensuring the consumer a safe product. It also kills other types of harmful or undesirable microorganisms, thus making it possible to control better the desirable bacterial fermentation by the addition of scientifically prepared bacterial starters. Research in the United States Department of Agriculture has proved that pasteurization of the milk, in the cases of numerous kinds of cheese, greatly improves the quality and uniformity. At least one half of the cheese made in the United States is made from pasteurized milk, and the use of the process is increasing rapidly. The United States Department of Agriculture has developed a so-called phosphatase test, by which the use of unpasteurized milk can be detected in cheese (Sanders-Sager Test). Regulations of the Food and Drug Administration in the United States require that the milk for Cottage and other unripened varieties be pasteurized and that the milk for most of the ripened varieties be pasteurized or the cheese ripened for a definite period—usually 60 days—before retail sale. Some kinds, such as Swiss, have not yet been made successfully from pasteurized milk, and in such cases a definite ripening period is legally required in order to meet government regulations.

Pasteurized Processed Cheese.—The manufacture of processed cheese has become an important part of the cheese industry. Processed cheese is made by grinding, mixing, and pasteurizing ripened, natural Cheddar cheese, or a blended mixture of various cheeses, usually with a chemical emulsifier, salt, and annatto color, and packaging the hot product in sanitary, attractive packages or glass containers. Nonfat milk solids, concentrated or powdered whey, pimientos, olives, and other non-cheese foods sometimes are blended and pasteurized with cheese mixtures, including Cream cheese, and the products are sold in sanitary, attractive packages or glass jars as pasteurized processed cheese foods. The softer blends are marketed as cheese spreads. At least one third of the natural cheese made in the United States is reworked thus and marketed as processed cheese.

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duction of Manufactured Dairy Products (Washington, issued annually).

GEORGE P. SANDERS,
Chemist, Division of Dairy Products Research
Laboratories, Bureau of Dairy Industry, United
States Department of Agriculture.

CHEESE FLY, a small, black, dipterous insect bred in cheese, belonging to the Muscidae, the same family to which the housefly and blowfly belong. It has a very extensible ovipositor, which it can sink to a great depth in the cracks of cheese and lay eggs there.

The maggot, well known as the cheese hopper, or cheese skipper, is furnished with two horny claw-shaped mandibles, which it uses both for digging into the cheese and for moving itself, since it has no feet.

CHEESMAN, Forman, American ship-builder and naval architect: b. New York, N. Y., Dec. 11, 1763; d. there, Oct. 10, 1821. The son of a New York shipbuilder, he constructed his first ships in his father's yards on New York's East River front between the present Pike and Rutgers streets.

During a partnership with Charles Brownne, builder of Fulton's *Clermont*, his yards were further uptown at Clinton and Cherry streets. Cheesman received the contract from the United States government for construction of the famous 44-gun frigate *President* which was built and launched (1800) in the yards of Christian Bergh. What share of credit each of these noted builders deserves for the design and construction of this model of 18th century naval architecture it is impossible to determine. Later, during his partnership with Brownne, Cheesman built some of the finest ships of the day, including the *Silenus*, the *Triton*, and the *Illinois*.

CHEETAH, ché'tà, a large, spotted, maned cat (*Acinonyx jubatus*), also known as hunting leopard. It occurs throughout Africa except in the humid forested parts, and in Asia in the more or less arid regions from India and Russian Turkestan to Syria and Arabia. The cheetah is comparable to a greyhound in the slender form of its body and the length of its legs. The cat is highly specialized for running and is regarded as the fastest animal on earth. A full grown male measures from four to five feet in combined head and body length; the tail is about two-thirds as long. The weight of the animal varies from 100 to 200 pounds. Females weigh half as much and are from one-third to one-fourth less in bodily dimensions. The ground color of the body is gray, buff, or tawny, marked with closely set solid spots, rarely with blotches or bands. A conspicuous black stripe extends from the eye to the mouth on each side. The mane of the cheetah is a remnant of an extensive matlike growth of long hair that covers the whole upper side of the cubs. A more important distinctive character is the absence on the toes of protecting sheaths for the claws when retracted.

The cheetah is mainly diurnal, lives in open plains or bordering foothills, and makes its den in any kind of cover or rocky shelter. It climbs when young but seldom does so when adult, unless treed by dogs. Instead of stalking or ambushing and leaping on its prey from close quarters, like the majority of cats, the cheetah runs down its quarry by sheer speed of foot. A cheetah can

travel at a speed of 65 or, in a short spurt, 70 miles per hour, but its endurance is low. The maximum speed can be maintained for probably no more than 100 yards, and the distance of a quarter mile is covered at the rate of 45 miles per hour, or in about 20 seconds.

The cheetah is easily tamed but is not known to reproduce in captivity. It is docile and quiet and can be led on a leash. Employment of cheetahs for coursing antelopes and other fleet-footed game dates from the pre-Christian era. In India, the cheetah is usually taken blindfolded in a cart to the scene of the hunt. In the proximity of a herd of antelopes, it is unhooded and unleashed. If the quarry is near, the cheetah captures it after a few bounds. If, however, the antelopes have a good running start, the cat may become winded and abandon the chase.

CHEETHAM, chêt'am, James, Anglo-American journalist: b. in or near Manchester, England, c.1772; d. New York, N. Y., Sept. 19, 1810. He worked as a hatter in Manchester and, after joining the Constitutional Society there, was arrested in July 1793 and imprisoned with others of his society on charges of conspiring against the government, but was released the following April, for lack of evidence. The Manchester riots of 1798 caused him to emigrate to the United States. Settling in New York, he bought a half interest in Thomas Greenleaf's *Argus*; in partnership with David Denniston, a cousin of De Witt Clinton, he published it from May 1, 1801, as *The American Citizen*, a daily devoted to the Republican (modern Democratic) cause. In the split between the Clinton and Burr factions, he espoused the Clinton side and bitterly attacked Burr whom he charged with making a treacherous alliance with the Federalists. His opposition to the Embargo Act (1807), however, cost him the favor of the Clintonians. He wrote a very prejudiced *Life of Thomas Paine* (1809).

CHEEVER, Ezekiel, American educator: b. London, England, Jan. 25, 1615; d. Boston, Mass., Aug. 21, 1708. Having received a good classical education at Christ's Hospital and Emmanuel College, Cambridge, he emigrated to America in 1637, going first to Boston and then, in 1638, to New Haven, where he was appointed master of the public school. In 1650 he moved to Ipswich to become head of the Free School, which he made famous throughout the New England colonies. In 1661 he established a school at Charlestown, and then in 1670 was appointed master of the renowned Boston Latin School, over which he presided for 38 years. He was one of the most notable schoolmasters of colonial America. His *Accidence, a Short Introduction to the Latin Tongue* was a standard text in New England schools for almost 200 years; it had its 20th edition in 1785 and was reprinted as late as 1838. He also wrote a group of three essays entitled *Scripture Prophecies Explained*.

CHEEVER, George Barrell, American clergyman: b. Hallowell, Me., April 17, 1807; d. Englewood, N. J., Oct. 1, 1890. He was graduated at Bowdoin College in 1825 and at the Andover Theological Seminary in 1830. In 1838 he became pastor of the Allen Street Presbyterian Church in New York, and from 1846-1867 was pastor of the Church of the Puritans, New York. He distinguished himself as an

antislavery advocate in the period prior to the American Civil War. During 1845–1846 he was editor of the *New York Evangelist*, and at various times he was connected with the *New York Observer* and *Independent*. He was an able and vigorous writer and speaker, and the author of a large number of works in prose and verse. Among his publications are *Studies in Poetry* (1830); *God's Hand in America* (1841); *Poets of America* (1847); *Windings of the River of the Water of Life* (1849); *The Voice of Nature and Her Foster-Child, the Soul of Man* (1852); *Lectures on the Life, Genius, and Insanity of Cowper* (1856), arguing that Cowper's religious terrors proved him sane instead of insane; and *God Against Slavery and the Freedom and Duty of the Pulpit to Rebuke It* (1857). One of his most effective works was *Deacon Giles' Distillery*.

CHEFOO, ch'fōō', China, treaty port in the province of Shantung, most easterly of the Chinese provinces. The port was opened to foreign trade in 1863. It is served by the railway between Tsingtao and Tsinan. The city is the center of the hairnet industry of China, and it is also important as a fruit and fishing center. Numerous factories make pongee silk and bean oil, and these, together with straw braid, constitute the principal exports. Pop. (1947 est.) 227,000.

CHEHALIS, chē-hā'lis, town, Washington, county seat of Lewis County, situated at an altitude of 204 feet, 35 miles south of Olympia; it is served by the Northern Pacific, Union Pacific, Great Northern, Chicago, Milwaukee and St. Paul, and Cowlitz, Chehalis, and Cascade railroads. Chehalis has lumber and milk-processing plants. It has a commission government. Pop. (1950) 5,639.

CHEHALIS RIVER, Washington, in the southwestern part of the state. It rises in Lewis County, flows north-northwest through Chehalis County, into Gray's Harbor. Its length is 125 miles, and is navigable for light steamers some distance from the mouth.

CHEILOGNATHA, kī-lōg'nā-thā, or **CHIOGNATHA**, also known as *Diplopoda*, one of the two orders of *Myriapoda*, including the millipedes (q.v.) and other forms. See also *MYRIAPODA*.

CHEILON. See *CHILON*.

CHEIROLIN, kī-rō-līn, is a colorless and odorless crystalline compound having the formula $C_6H_5NO_2S_2$, a molecular weight of 179, and a melting point of 47°C. Cheirolin is found as a glycoside in seeds of *Cheirinia cheiri*, the wall-flower, and in some species of *Erysimum*.

CHEIROPTERA, kī-rōp'tē-rā, an order of mammals, the bats, closely related to the insectivores and characterized by the immense extension of the forelimbs so as to form wings and by other adaptations of the skeleton for an aerial life. The order is divided into two groups: *Megachiroptera* and *Microchiroptera*. The former consists wholly of the great fruit-eating bats of the Old World tropics; the latter contains all the remaining families. They are separated principally by dental features. See also *BAT*.

CHEIROTHERIUM. See *LABYRINTHO-DONTA*.

CHEJU, chā'jōō, an island 60 miles south of Korea, known also as *QUELPART ISLAND* and, to the Japanese, as *SAISHU*. It is 700 square miles in area, and is mountainous, the highest point being the volcanic Halla-san (6,398 feet). Fishing and farming are the principal industries, most of the work being done by women. Quantities of seaweed are exported, and also clam shells which, because of their iridescent mother-of-pearl character, are used for inlaying lacquer. American missionaries are active on the island. According to tradition, three divine men came out of caves (still to be seen) and founded the country of Tamna, as Cheju was originally named. The island paid tribute to the mainland as early as 100 A.D., and later was incorporated into Korea. The capital is Cheju, located on the northern coast of the island; in 1946 the entire island had a population of 276,148, of whom 57,573 lived in the capital.

CHEKE, chēk, **SIR JOHN**, English classical scholar: b. Cambridge, June 16, 1514; d. London, Sept. 13, 1557. He was educated at Cambridge University, where he became regius professor of Greek in 1540, a post he occupied until 1551. Meanwhile, he was appointed tutor to the prince of Wales (later Edward VI) in 1544, and was named provost of King's College, Cambridge, in 1548. In 1551 he was knighted, but in 1553, because he served as secretary of state for Lady Jane Grey during her reign of nine days, he was arrested on the orders of Queen Mary. Released the following year, he went abroad, visiting Switzerland and Italy before settling in Strasbourg, where he supported himself by teaching Greek. In 1556 he was seized near Brussels when returning from a visit to his wife and sent to England. There through John de Feckenham he recanted his Protestant beliefs and was received into the Roman Catholic Church by Cardinal Pole. His chief distinction was the impulse given by him to the study of Greek.

CHEKHOV, **CHEKOV**, or **TCHEKHOV**, chā'kōf, **Anton Pavlovich**, Russian playwright and fiction writer: b. Taganrog, Jan. 17, 1860; d. Badenweiler, Germany, July 2, 1904. He took a medical degree at Moscow in 1884 but practiced his profession for only a short period. At the age of 19 he began writing short stories under the pen name of "Chekhonté." The favorable reception accorded his first volume of stories encouraged him to desert medicine for literature, where his scientific training was to prove of inestimable value. His mental trend was from the first inclined to the banal aspects of Russian life. With grim satire he seized on all that was petty, mean, and sordid in human character, and with Maksim Gorki (Maxim Gorky), became one of the most prominent exponents of the Russian school of sordid realists. Chekhov's writings reveal a crowded stage of humble characters—aristocrats are excluded—photographed from life. merchants, students, priests, schoolmasters, saloon-keepers, magistrates, neurotics, lunatics, officials, with all their mean sordidness and narrow-minded simplicity. Where he introduces doctors—which is frequently—he revels in describing physical and mental diseases, of which latter *The Black Monk* is the best example. An atmosphere

of sadness and hopelessness pervades his characters and impresses itself upon the reader. Yet Chekhov is one of the great masters of the modern short story—brilliant, of penetrating psychology, with a remarkable flow of language, and a weird faculty of suddenly turning a humorous situation into a painful tragedy. His fame rests on his stories and such plays as *Ivanov* (1887), *The Sea-gull* (1896); *Uncle Vanya* (1899), and *The Three Sisters* (1901); his dramatic masterpiece was *The Cherry Orchard* (1904, q.v.).

Consult Toumanova, Nina A., *Anton Chekhov, the Voice of Twilight Russia* (New York 1937); Bruford, W. H., *Chekhov and His Russia* (New York 1948); and Magarshack, D., *Chekhov, a Life* (London 1952).

CHEKIANG, jū'ji-āng', province, China, on the East China Sea, lying north of Fukien and south of Kiangsu. The area, including the Chu Shan Archipelago, is approximately 39,750 square miles, and the population, as estimated in 1952, was 19,942,000. Most of the surface is mountainous, drained by numerous rivers. The province is rich in mineral deposits, coal being found in the north and iron ore in the south, while traces of copper occur in several places. Though comparatively small, densely populated Chekiang is among China's most fertile provinces. A high grade of tea is grown on the mountain slopes, and in the lowlands large areas are devoted to rice, cotton, peanuts, wheat, and beans; silk is also an important product, and there are extensive fisheries. Hangchow, the capital, is connected with Peking by the historic Grand Canal; it was one of the first treaty ports to be opened to foreign commerce. Other such ports were Ningpo (now Ninghsien) and Wenchow (now Yungkia), the latter at the mouth of the Wu Kiang. Ninghsien and Hangchow are connected by rail northward with Shanghai, and a railroad extends across Chekiang in a southwesterly direction, affording communication with Kiangsi Province.

Marco Polo visited Chekiang in the 14th century, viewing many beautiful temples which subsequently fell into ruins. During 1861 the province suffered great spoliation at the hands of the Taipings (q.v.); and it was frequently the scene of fighting in the Chinese civil wars of the early part of the 20th century. The Japanese caused considerable damage during their occupation in World War II. Chekiang passed to Communist control in 1949.

CHELAN, Lake, shě-lān', Washington, in Chelan County, bordered on the west shore by the Chelan Range, a branch of the Cascades. Lying in a glacial gorge at an altitude of about 1,000 feet, the lake extends approximately 55 miles and is from 1 to 2 miles wide. Fed chiefly by the Stehekin River at its northwest end, it drains into the Columbia River at the southeast end where the resort town of Chelan (1950 pop. 2,157) is located.

CHELIA, Djebel, jā-bēl' shā-lyá' (Arab. JEBEL SHELIA, jā'bāl shā-lī'yá'), highest peak of Algeria, North Africa, in the Aurès Mountains of the Atlas Range, about 50 miles northeast of Biskra. The Djebel Chélia rises to 7,641 feet.

CHELIF, shā-lēf', or **SHELIF**, shē-lēf', river, Algeria. Rising in the Atlas, the Chélif flows for about 430 miles first north and then west—parallel to the coast through a fertile valley—to the Mediterranean northeast of Oran.

The country's principal stream, it is used for irrigation and, since 1942, for hydroelectric power.

CHELLEAN EPOCH, chēl'ē-ān, in archaeology, pertaining to the culture of the early Paleolithic, the name deriving from Chelles (Seine-et-Marne), France, where chipped stone axes, borers, and scrapers were unearthed. In this epoch man first learned to shape stones for use as instruments. The Chellean Epoch corresponds to the last interglacial period. See also **STONE AGE**.

CHELLY CANYON. See **CANYON DE CHELLY**.

CHELM, kēlm (Russ. Kholm, kôlm), city, Poland, in Lublin Province, about 40 miles east of Lublin, near the USSR border. It is a rail junction, also a processing and trading center for productive farming region. Awarded to Austria in 1795 and to Russia in 1815, it was returned to Poland in 1921. Chelm was the site of a German World War I victory (August 1915) over the Russians. In World War II, a new Polish Republic was proclaimed here on July 22, 1944. Pop. (1946) 23,329.

CHELMNO, kēlm'nô (Ger. CULM or KULM, koolm), city, Poland, in Bydgoszcz Province, on the Vistula, about 24 miles northeast of Bydgoszcz (Bromberg). Its industries include iron and engineering works, furniture factories, saw and flour mills, and breweries. The town developed around a fort built by the Teutonic Knights in 1231. It became a bishopric in 1245 (moved to Pelplin in 1821). Later Chelmno flourished as a member of the Hanseatic League, and was a part of Poland from the 15th to the 18th centuries. Prussia held it until it was transferred after World War I to Poland. Pop. (1946) 11,634.

CHELMSFORD, chēms'fērd, English baronial title held by members of the Thesiger family. The 1st Baron Chelmsford was **FREDERICK THESIGER** (1794–1878). Grandson of a Saxon immigrant, he served as a midshipman in the navy, was called to the bar in 1818, and at the Chelmsford assizes won a famous case in 1832; years later he chose the town name for title. Solicitor general in 1844 and attorney general in 1845, he was appointed lord chancellor in 1858.

His eldest son, **FREDERIC AUGUSTUS THESIGER** (1827–1905), succeeded as 2d baron. Entering the army he served in the Crimean War, was adjutant general in the Abyssinian campaign of 1868, and adjutant general of the forces in India (1869–1874). Promoted major general in 1877, he had chief command of the British troops in the Zulu War of 1879, defeating Cetewayo. His eldest son, **FREDERICK JOHN NAPIER THESIGER**, 1st Viscount Chelmsford (1868–1933), was viceroy of India (1916–1921) and held other high offices.

CHELMSFORD, England, municipal borough and county town of Essex, at the confluence of the Chelmer and the Cann, about 30 miles northeast of London. Manufactures include agricultural implements and electrical machinery. Its church of St. Mary dates from the 14th or 15th century; and the grammar school was founded by Edward VI in the 16th century. Pop. (1951) 37,888.

CHELMSFORD, chēms'fērd, town, Massachusetts, in Middlesex County; altitude 149 feet; about 4 miles southwest of Lowell; on the New York, New Haven and Hartford Railroad. Chelmsford is in an agricultural region and has textile, beverage, wool processing, and wooden box manufactures. The Billerica State Forest is nearby. Historic buildings include the Fiske House dating from 1790 and the Unitarian Church erected in 1840. The town was settled in 1633 and incorporated in 1655. Government is by selectmen. Pop. (1950) 9,407.

CHELSEA, chēl'sī, metropolitan and parliamentary borough, England, in Middlesex County; a southwestern suburb of London (area 1.03 square miles); on the north side of the Thames River, and chiefly distinguished for the royal military hospital that is located there. Situated on the left bank of the Thames, it is, like the famous left bank of Paris, renowned for its historic association with literature and art. Many artists and writers have lived in Chelsea. Among them, Dante Gabriel Rossetti, Leigh Hunt, Sir Robert Walpole, J. M. W. Turner, Whistler, Count D'Orsay, and Thomas Carlyle. In the 17th and 18th centuries Chelsea was the home of Francis Atterbury, Jonathan Swift, Steele, and Smollett. The house in Cheyne Row where Carlyle, known as the "Sage of Chelsea," lived for nearly 50 years is preserved as a monument to his memory, and many Carlyle relics are displayed therein. In the Cheyne Walk is a tablet indicating that Turner died there in 1851. Whistler also lived and died in Cheyne Walk. The borough is also famous for its Royal Hospital and Chelsea Old Church. See LONDON—*Ecclesiastical London* (Pre-Fire Churches).

The Duke of York's School for the children of soldiers, formerly situated near the hospital, has been removed to Dover. There are great military barracks at Chelsea, but these are not within the boundaries of the borough. Chelsea has a public library replete with a rare collection of books on local history. The borough returns one member to Parliament.

The Hospital.—The Royal Hospital, Chelsea, for old and invalid soldiers was begun in the reign of King Charles II. According to tradition he acted at the instigation of Nell Gwyn who never forgot her humble origins and loved to help the aged and the poor. The expense was undertaken at a time when the exchequer of Charles was at a low ebb, and he could ill afford it. The work was carried on during the reign of King James II and finished in that of William and Mary by Sir Christopher Wren, in 1692. It is also a military museum wherein are displayed the colors captured in historic British battles, including Waterloo. There are also other military exhibits.

Chelsea Hospital grounds cover about 66 acres. A building was originally commenced here by James I as a theological college, but it was never finished. Ranelagh (q.v.), often referred to in English literature, a fashionable resort and place of entertainment in the 18th century, was located in the grounds of Chelsea Hospital. Early in the 19th century its popularity waned, and it was closed. Cremorne Gardens, popular and fashionable in the mid-19th century, also were situated here.

The commissioners of the hospital administer the Army Pension List. All pensions are granted

by these commissioners, and most of the recipients are known as out-patients. Their number runs into many thousands. From these the in-patients are selected. The number of in-patients runs into the hundreds; they are soldiers maimed or disabled in military service, or who have served for 21 years. On May 29th, which is known as Oak Apple Day, the old Chelsea pensioners don their scarlet frock-coats to celebrate the occasion. Oak Apple Day commemorates the time when King Charles lay hidden in the branches of an oak tree while Cromwell's "Ironsides" were searching for him. Pop. (1951) 50,912.

CHELSEA, city, Massachusetts, Suffolk County; altitude 10 feet; on the Boston Harbor between the Mystic River and Chelsea Creek estuaries; 3 miles north of Boston and sharing that city's port facilities; served by the Boston and Maine and the New York Central railroads. Chelsea is chiefly an industrial city, but is also an important shopping center for surrounding suburban communities. Its manufactures include shoes, lithographic materials, elastic goods, foundry products, chemicals, and food and wood products. Chelsea's main business section, most of its public buildings, schools and churches, and a large residential area are of new construction since the great fire of April 12, 1908. At that time 492 acres in the heart of the city were ravaged, and 17,000 people were left homeless. The city was rebuilt within two years, and it has since had its largest commercial development.

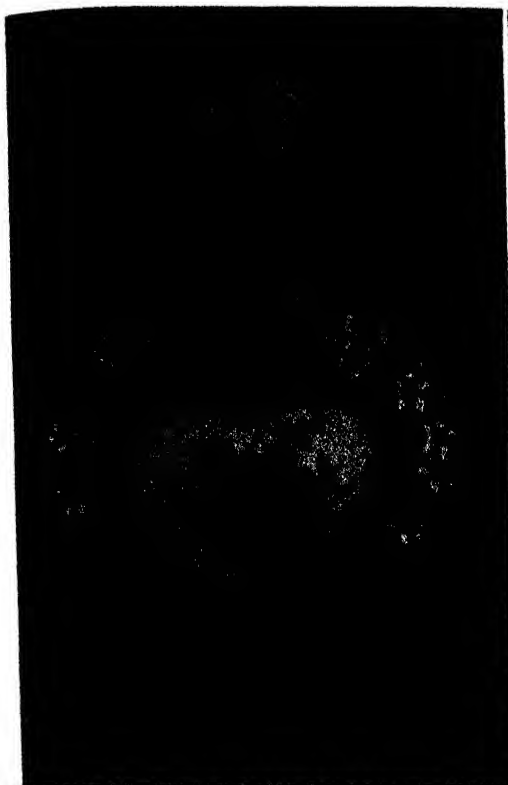
Chelsea has a city hall whose design is based on that of Independence Hall in Philadelphia; a Carnegie public library; excellent public parks; and an 8,500-seat War Memorial Stadium in Carter Field. The Massachusetts Soldiers' Home is here, and there is a United States Naval Hospital. Founded as a trading post by Samuel Maverick in 1624, Chelsea was known by its Indian name of Winnisimmet and was a part of the town of Boston until it was set off as a separate township in 1739. It received its city charter in 1857, and has a mayor and aldermen. Pop. (1950) 38,912.

CHELSEA PORCELAINS. The first successful English porcelains were made in Chelsea. The factory stood in what is now a borough of London, along the Thames and a mile from Buckingham Palace, but then classed as a "large and populous village one mile west of St. James's Park." Practically from the start, useful wares, figures and other ornamental pieces were made, and from 1745 to 1784 Chelsea dominated English porcelain manufacture in quality and quantity. This was due to the skill and business acumen of three men, Charles Gouyn, Nicolas Sprimont, and William Duesbury. The first was a jeweler, the second a silversmith, and the third a porcelain decorator.

Chelsea porcelains are divided into five periods: Triangle, 1745–1750; Raised Anchor, 1750–1753; Red Anchor, 1753–1758; Gold Anchor, 1758–1770; and Chelsea-Derby, 1770–1784. In 1784 the Chelsea factory was dismantled and its models shipped to the Derby porcelain factory by Duesbury who owned both.

As far as is known the first pieces of Chelsea were small cream jugs, marked on the base beneath the glaze with an incised triangle. There are known examples where this mark is augmented by the word *Chelsea* and the date 1745

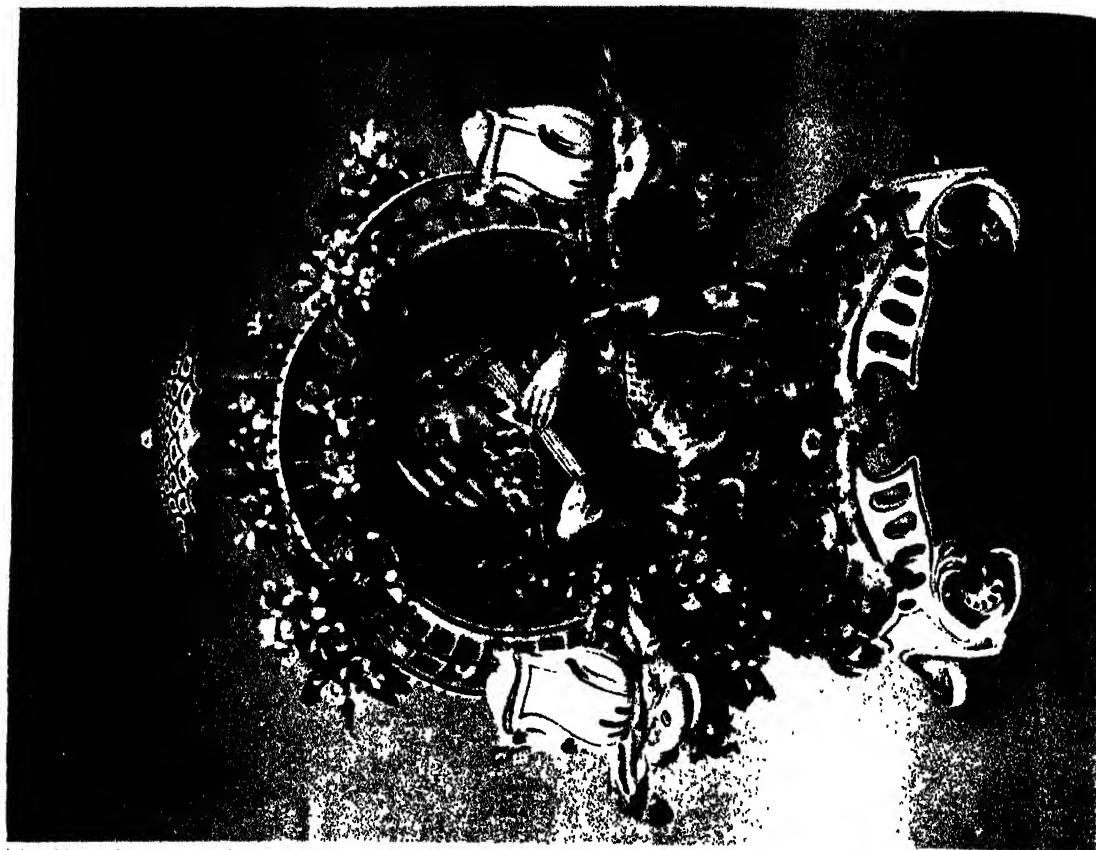
CHELSEA WARE



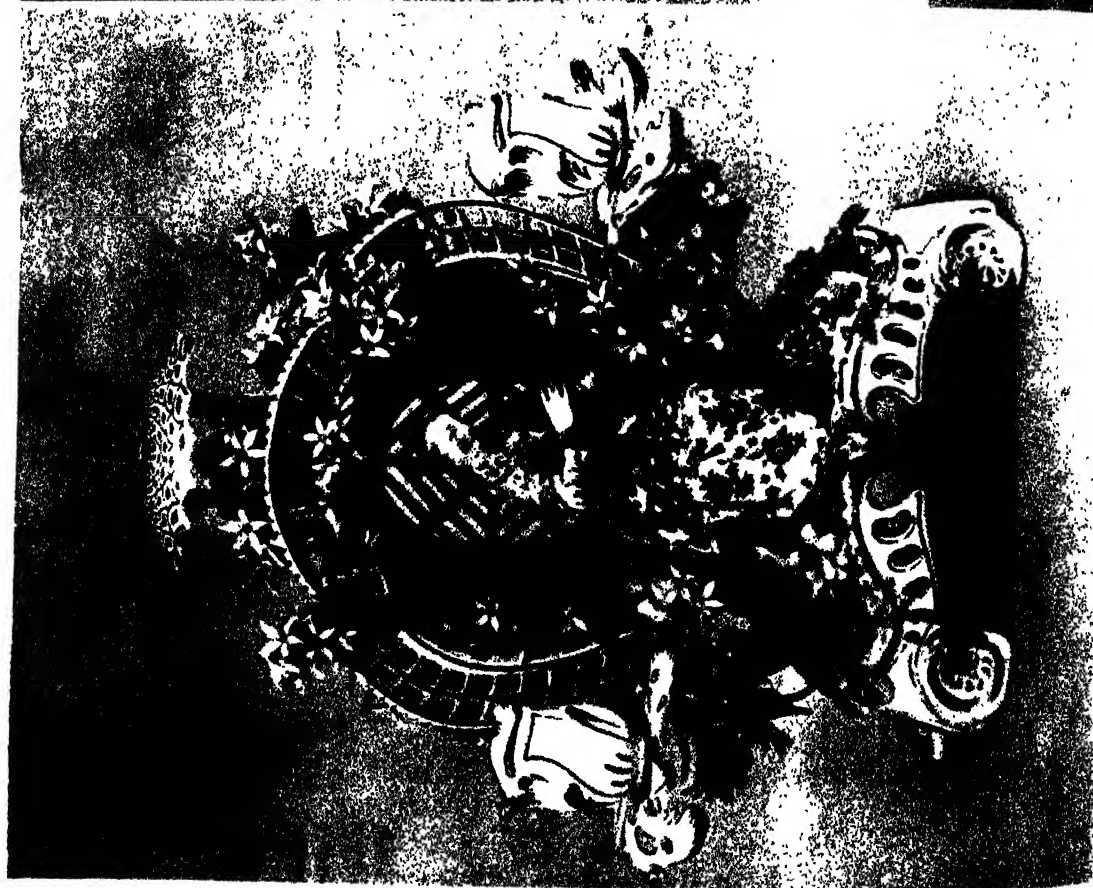
Courtesy of The Metropolitan Museum of Art, New York

Top left: Vase with heart medallion decoration. Openwork neck (between 1757-1770).
 Top right: Vase with "Exotic" bird motif, rococo handles (late 18th century).
 Bottom: Pair of candlesticks. "Rustic" figures on rococo scroll bases (late 18th century).

CHELSEA WARE



Courtesy of The Metropolitan Museum of Art, New York



Known as "bee and goat" jugs because of their design, the body is supported on the backs of two reclining goats and decorated on the front with sprays of flowers in relief on which a nicely modeled bee has alighted. Earlier silver originals, from which this design was copied, bear the London hallmarks for 1724 and 1737-1738.

Charles Gouyn, who started porcelain making at Chelsea, was a Huguenot jeweler who settled in London sometime before 1745. The close similarity between the paste and glaze of very early Chelsea pieces and those of the French porcelain factories makes it tenable that he employed one or more fellow Huguenot refugees with intimate knowledge of porcelain making as practiced at St. Cloud, Chantilly, or Mennecey-Villeroy. Also, distinctly English modeling of some of the Chelsea figures attributed to the Triangle period indicates that some of his employees were probably recruited from Staffordshire.

Chelsea pieces of this period have a soft glass-like paste and a soft white shiny glaze that is not likely to craze. Those of the useful wares, especially, are very translucent and have a pale misty ivory tone with tiny pinholes in the glaze brighter than the surrounding surface. These useful wares have a raised decoration inspired by the Chinese or Japanese and derived via Meissen. Shapes were consistently borrowed from contemporary silver and are now known as "silver shapes." Outstanding and rare examples of these wares, in addition to the goat and bee pitchers, are shell-shaped salt dishes, tall coffee tops with applied floral sprays, and teapots in the form of a grotesquely modeled Chinese.

Figures were in the minority during the Triangle period. Most of them are in the white glaze but a few have small sprays or sprigs of flowers that may have been added by outside decorators. The modeling is French but the posing, English.

There were notable changes in 1750. First, Nicolas Sprimont replaced Charles Gouyn. Sprimont was born in Liège, France and by 1742 was working in London as a silversmith. He recognized the need of backing by a person of prominence for his porcelain venture and so secured the interest of William Augustus, duke of Cumberland and son of George II, who bespoke (that is, ordered) a set of Chelsea "for his own table." This quasi patronage by royalty was accomplished through Sir Everard Fawkener (1684-1758), a man of wealth with important connections which he used for the benefit of the venture, such as arranging with Sir Charles Hanbury Williams, then in Dresden for the loan of some Meissen porcelains for use as models "to furnish the undertakers with good designs."

Fawkener continued to be closely associated with Chelsea until about the time of his death in 1758 when he left his family in "reduced circumstances." His connection with the business covered the Raised Anchor and Red Anchor periods when Meissen influence was at its height. His high regard for the Saxony porcelain works probably accounts for this since after Sprimont became sole proprietor the influence of Sèvres and other French factories were steadily more marked.

By 1754 the Chelsea factory was on such an extensive footing that its first annual auction of useful and ornamental porcelains was announced in the *Public Advertiser* for March 29. It lasted for 14 days and was so successful that another, devoted entirely to patch boxes and kindred

small pieces, known as toys, was held. The annual sale of 1755 lasted 16 days. Statistical analysis of the lots listed shows that there were items of 9,600 useful wares and 800 figures and other ornaments. Since the factory was also maintaining a salesroom in Pall Mall, it is likely that about half as much more Chelsea was sold there. Adding in the pieces made on order, an estimate of an annual production of approximately 15,000 pieces of useful wares and 1,200 figures and other ornaments seems warranted.

Pieces in this sale must have borne the Red Anchor mark since this period lasted from 1753 to 1758 and during it the best Chelsea figures were produced. Just when the Red Anchor completely replaced the Raised Anchor has never been established. For a while both were used interchangeably and there was no break in form of pieces or style of decorating.

The Red Anchor paste is of a colder white than that of the Raised Anchor period and has the so-called moons of greater translucence in the body. They were the result of adding coarsely ground frit to the mixture to make the pieces stand up better during firing. The Red Anchor mark with rope ring at the upper end is small, always in overglaze enamel done in red or sometimes brown. A few are known where the anchor is in blue without the ring.

The year 1758 marks the beginning of the Gold Anchor period which continued to 1770. During it Sprimont remained at the head of the factory until 1769 when he sold the business to James Cox who within the year sold it to William Duesbury. The character of Chelsea porcelains changed materially in this period. A new paste containing as much as 40 per cent bone ash was adopted. A number of new techniques were perfected, including colored ground colors and the rococo influence was high. Due to wars on the Continent, the Meissen influence declined and the style of the Sèvres factory became the one which set the fashion.

Under this French influence, Chelsea increased its use of ground colors, including mazarin blue, turquoise, yellow, green and a particular shade of red, often referred to as claret. This was one of the factory's triumphs that resulted from an attempt to copy the rose Pompadour of Sèvres. Elaborate gilding was also added to the decorations. The mark for this period is a small anchor with rope ring at upper end done in over-glaze gilt. The paste is soft and uniform without the earlier moons. The glaze has a high brilliance but is thick and glassy and sometimes forms small pools with a greenish tinge. It is either off-white or very white and some pieces show parallel crazing. Pieces are very translucent and show a shade of either pale pinkish ivory or an even whiteness.

In 1770 William Duesbury, owner of the Derby factory, became the proprietor of Chelsea. With this came the start of the Chelsea-Derby period which lasted until 1784 when all production was transferred to Derby. Although pieces of this period are excellent examples of 18th century English porcelain, they are not held in as high regard as earlier Chelsea. The Chelsea-Derby mark is a combination of the anchor and a capital script D, sometimes side by side and sometimes combined as a cipher. See also DERBY PORCELAINS.

CHELSEA VILLAGE, now part of New

York. The name is preserved in Chelsea Square between Ninth and Tenth avenues and Twentieth and Twenty-first streets. Clement C. Moore, author of *'Twas the Night Before Christmas*, owned a farm here in the early 19th century.

CHELTENHAM, chēlt'nām, municipal borough, England, a popular watering-place in the county of Gloucester, seven miles northeast of the city of Gloucester, on the river Chelt, a short tributary of the Severn, 85 miles from London. It is a city of gardens, protected by hills and surrounded by beautiful scenery. Cheltenham spas first occasioned the rapid growth of the town, but the baths and springs are less frequented than formerly. The springs were discovered in 1716, but became famous in 1788 through a visit paid to them by George III. There is a college for boys (founded in 1840), the ladies' college (founded in 1854), and a Church of England teachers' college. Industries include the manufacture of bricks, rubber goods, aircraft, and anaesthetics. Cheltenham returns one member to Parliament. Pop. (1947 est.) 64,420.

CHELTENHAM, township, Pennsylvania, in Montgomery County, altitude 65 to 415 feet, on the Reading Railroad, 11 miles north of Philadelphia, and on state highways. It has furniture and hosiery factories, and is the seat of two private schools. First settled in 1690, it was incorporated as a township in 1900. It has commission government and a city manager. Pop. (1930) 15,731; (1940) 19,082; (1950) 22,854.

CHELYABINSK, chī-lyá'byĩnsk, or **CHELIABINSK**, city, USSR, on the left bank of the Mias River, 125 miles south of Sverdlovsk, with which it is connected by rail, as also with all the major industrial regions of the USSR. An agricultural and coal region, it manufactures farm machinery and tanks. Pop. (1939) 273,127.

CHELYUSKIN, chī-lyōōs'kĩn, or **CHELIUSKIN**, Cape (also NORTHEAST CAPE or CAPE SEVERO), USSR, the extreme northern point of Asia, on Taimyr Peninsula. It was named after a Russian officer who led an expedition thus far in 1742, and there succumbed to the fatigues of the journey; it was not revisited until 1778, when Nils Adolf Nordenskjöld, in the *Vega*, spent August 19th and 20th there.

CHEMICAL AFFINITY, the force or tendency which causes two or more dissimilar substances to combine in definite proportions to form a new substance whose properties are distinct from those of any of the constituents. The word *affinity* was originally employed in this sense because it was believed that a kind of relationship existed between substances that are capable of combining with one another. In the time of Aristotle the constituent particles of bodies were conceived to be endowed with qualities somewhat akin to love and hate. After the advent of Galileo, these notions were exchanged for equally erroneous but more mechanical ones, and the ultimate particles were represented, in thought, as provided with hooks and other similar devices, by means of which their combinations were conceived to be effected. Later, when the law of universal gravitation was propounded by Newton, the force impelling the atoms toward

one another, and holding them in their combinations, was naturally enough pictured as a special form, or manifestation, of gravitative action.

Modern science accounts for the tendency of one element to combine with another on the basis of atomic structure. The number and arrangement of the electrons surrounding the positive nucleus determine the chemical character of an element. The electrons in the outermost orbit or shell are the *valence electrons* which are involved in chemical reactions. For example, the sodium atom has a single electron in its outermost shell and this electron is very easily removed. The chlorine atom has 7 electrons in its valence shell. An outside shell of 8 electrons is remarkably stable. Hence the chlorine takes an electron from the sodium atom to complete a shell of 8 electrons; the sodium atom in losing its single valence electron exposes a stable shell of 8 electrons. The sodium atom has a positive charge and the chlorine atom a negative charge, and the crystal of sodium chloride is made up of alternate atoms of opposite charge. When a chlorine atom combines with a hydrogen atom, there is a sharing of electrons, one from the hydrogen and one from the sodium, and a bonding pair is formed.

The further the valence electrons are from the nucleus, the more easily are they lost. In the old terminology it would have been said that chlorine has a greater affinity for potassium than it has for lithium. The modern concept is that the potassium atom loses its valence electron more readily because it is much further from the nucleus than the valence electron of lithium. In the same way, fluorine attracts an electron from sodium much more readily than does iodine because its valence shell is nearer to its nucleus and has greater drawing power.

The activity of elements can be measured by electromotive forces, ionic concentrations being made equal. Measured against a hydrogen-hydrogen ion half cell, a zinc-zinc ion half cell has an electromotive force of -0.76 volt, while a cadmium-cadmium ion half cell would give a value of -0.40 volt. In the old system it would have been said that a given element had a greater affinity for zinc than for cadmium.

Matters of protective films, concentrations, temperatures, pressures, and catalysts must also be taken into consideration in connection with chemical reactions, and comparisons of activity can be made only when conditions are alike and interfering factors can be eliminated. See also ATOMIC THEORY; CHEMISTRY; ELECTRON THEORY; ELEMENT; PERIODIC LAW.

W. T. READ,
Chemical Adviser, General Staff, Department of
the Army.

CHEMICAL ANALYSIS or **ANALYTICAL CHEMISTRY**, that branch of chemistry which aims at finding the composition of any given sample. It is divided into *qualitative analysis*, the purpose of which is merely to find what elements or compounds are present in the sample, and *quantitative analysis*, the object of which is to find the exact percentage or concentration of the various constituents of the sample. A quantitative analysis cannot be performed until the qualitative composition is known. Analytical chemistry may also be divided into inorganic and organic analysis, depending on whether the sample is composed of inorganic or organic substances.

Ultimate analysis is concerned with finding the percentage or concentration of the elements in the sample. *Proximate analysis*, on the other hand, aims to find what percentage of a sample behaves in a certain way under specified conditions. Thus the determination of the percentage of soluble matter in a scouring powder and the determination of ash in coal are examples of proximate analysis.

Analytical chemistry may also be divided according to the size of the sample taken for analysis. Ordinary or *macroanalysis* usually starts with a sample of 0.1 gram to 5 grams. *Microanalysis* requires a sample of only about 0.002 gram. It is applied when the quantity of sample available for analysis is very small, as in biochemical investigation, criminological analysis, and the study of nuclear transformations. It is possible to remove a minute portion of an old masterpiece of painting without marring it and to investigate, by the techniques of microanalysis, the pigments used. Microanalysis is generally less accurate than macroanalysis. In semi-microanalysis, samples intermediate between those of macro- and microanalysis are used. Ultra-microanalysis is an extension of microanalysis into the realm of even smaller samples.

Chemical analysis is applied in almost all manufacturing processes to control the quality of the starting materials, the intermediates, and the finished products. Furthermore it is essential in the chemical and medical research by which new materials such as alloys, paints, lacquers, plastics, rubbers, and drugs are developed.

In industrial analysis, the problem of sampling is important. The manager of a steel mill where a shipload of iron ore has just been received wants to know the percentage of iron in the ore. How can the chemist be sure that the sample taken for analysis is truly representative of the shipload? A good sampling procedure consists in taking systematically one pound of material from each ton as it is unloaded. Thus a *gross sample* is obtained, still far too large to be handled in the laboratory. This is crushed and quartered by piling it into a cone, dividing the cone into quarters and retaining only two opposite quarters. This process of quartering is continued with intermittent crushing or grinding to finer particle size until a sample suitable for laboratory use is obtained.

QUALITATIVE INORGANIC ANALYSIS

Qualitative tests for cations (metallic ions) may be performed by the *wet method*. This means that the constituents are recognized by the reactions that they perform in solution. A traditional procedure for the detection of 24 so-called common cations by the wet method is described in the vast majority of textbooks of qualitative analysis, with only minor variations in procedure among the different books. Unfortunately, the list of 24 cations omits several industrially important metals such as vanadium and molybdenum and also omits the very abundant metal, titanium. A. A. Noyes and W. C. Bray have devised a procedure for the detection of 49 metals (*A System of Qualitative Analysis for the Rare Elements*, London 1927). This procedure is necessarily much more time-consuming than the one designed for only 24 cations.

The first step in qualitative analysis by the wet method is to dissolve the sample. If water alone fails to dissolve the sample, nitric acid or aqua

regia is usually applied. If insoluble material still remains, treatment with hydrofluoric acid or fused sodium carbonate is required.

The usual procedure consists of dividing the metals into seven groups. The addition of hydrochloric acid precipitates the chlorides of lead, mercurous (univalent) mercury, and silver. These constitute the silver group. They are removed by filtration. Treatment of the acid solution with hydrogen sulphide causes the precipitation of the sulphides of eight metals. This precipitate is filtered and treated with ammonium disulphide which dissolves the sulphides of arsenic, antimony, and tin (the arsenic group), leaving the sulphides of mercuric (bivalent) mercury, lead, bismuth, copper, and cadmium (the copper group). Lead appears in two groups because its chloride is too soluble to be completely precipitated with the silver group.

The filtrate from the copper and arsenic groups is then neutralized and treated with ammonium sulphide. Seven metals are precipitated, either as sulphides or hydroxides. After filtration, this precipitate is dissolved in acid and treated with sodium peroxide. Thus the iron group is precipitated (manganese, iron, cobalt, and nickel), while the aluminum group (aluminum, zinc, and chromium) remains in solution.

The filtrate from the iron and aluminum groups is treated with ammonium carbonate and alcohol to precipitate the carbonates of barium, strontium, calcium, and magnesium, which constitute the calcium or alkaline-earth group, while the sodium or alkali-metal group (sodium, potassium, and ammonium) remains in solution.

To analyze the silver group precipitate, the analyst pours some hot water through the filter. This dissolves the lead chloride as a colorless solution and leaves the precipitates of silver and mercury on the filter. The addition of potassium chromate to the filtrate causes the precipitation of yellow lead chromate, which serves as a test for lead. Next, the analyst pours ammonia solution through the filter. If mercurous chloride is on the filter, it is changed to a black mixture of metallic mercury and the compound HgNH_2Cl . The silver is dissolved by the ammonia as a complex ion. Upon the addition of nitric acid to the solution, silver chloride is reprecipitated as a white precipitate.

The space available does not permit a description of the analysis of the copper, arsenic, iron, aluminum and calcium groups. Since the sodium group is quite different from the others, we shall consider it briefly. The unusual feature of this group is the fact that the ions comprising the group form very few precipitates that can serve as tests for the cations. Sodium can be precipitated as sodium magnesium uranyl acetate, $\text{NaMg}(\text{UO}_2)_2(\text{C}_2\text{H}_3\text{O}_2)_6 \cdot 6\text{H}_2\text{O}$, and as sodium antimonate, NaSbO_3 . Potassium can be precipitated as the perchlorate and as a cobaltinitrite. Since ammonium ion forms precipitates with the same anions (negatively charged ions) as potassium, it is necessary to remove the ammonium salts before testing for potassium. This removal is accomplished by taking advantage of the volatility of ammonium salts. The solution is evaporated to dryness and the residue is heated to about 400°C .

The *flame test* is frequently used for sodium and potassium. This depends on the fact that compounds of sodium impart to a colorless flame of a Bunsen burner a brilliant yellow color, while

potassium colors the flame violet. To perform the test, the chemist simply dips a clean platinum wire into the solution to be tested, then holds the wire in the colorless Bunsen flame. The color from sodium is so intense that it obscures the violet color if both sodium and potassium are present. In that case, the chemist observes the flame through a blue glass, which absorbs the rays from the sodium flame but not those from the potassium flame. The flame test may also be used in the analysis of the calcium group. Calcium and strontium have a red flame, while barium gives a green color.

Ammonium ion is always present in the sodium group even though the original sample contained no ammonium salts. This is true because ammonium disulphide and ammonium carbonate are added to the unknown to precipitate the iron, aluminum, and calcium groups. Therefore the test for ammonium ion must be applied to a portion of the original solution. The most sensitive test consists in adding sodium hydroxide to the solution to convert the ammonium ion to ammonia. Upon warming the solution, the ammonia is volatilized. If the vapor is brought in contact with a solution of potassium iodomercurate, K_2HgI_4 , a yellow or brown color is produced.

Before the analyst applies the procedure outlined above, he must test for certain troublemaking anions and remove them if present. Phosphate, for example, may be precipitated as calcium phosphate when the solution is neutralized to precipitate the iron and aluminum groups. Thus calcium would be lacking from its normal group and would be present in the iron group, causing difficulty in the analysis of that group. Citrate and tartrate would prevent the precipitation of aluminum.

Qualitative tests for the anions by the wet method are less systematic than the procedure for the cations. Although several systematic procedures have been proposed, none has been widely adopted. The completion of the analysis for cations along with the knowledge of the solubilities of compounds gives the analyst very valuable clues as to what anions may and may not be present in the sample. For example, if the sample was dissolved completely in water and if silver was found to be present, none of the ions whose silver salts are insoluble in water would be present. These anions include chloride, bromide, iodide, cyanide, sulphide, chromate, and many others. Analogously, the presence of barium in a water-soluble sample proves the absence of sulphate.

In many cases, a complete qualitative analysis of the sample is not necessary, but it is desired only to ascertain whether one specified element is present. In such cases, *spot reactions* are valuable. Suppose, for example, that a chemist wishes to test for nickel in a given solution. He lets one drop of the solution fall upon a filter paper previously impregnated with an organic compound called dimethylglyoxime. If the solution is acid, he neutralizes the acid by bringing the paper in contact with ammonia fumes. If nickel is present, a red spot of nickel dimethylglyoxime is seen where the drop of unknown fell on the paper. A positive test is obtained if the drop contained only 0.00000002 gram of nickel. Spot tests as sensitive and simple as this one for nickel are not available for all of the common elements.

The geologist prospecting for ore will want to know the composition of many of the minerals without sending them back to the laboratory. He

will make use of *blowpipe analysis* in the field. By blowpipe analysis, the minor constituents of a sample are very likely to be overlooked; but the major constituents can be identified by a skilled worker. See BLOWPIPES AND BLAST LAMPS.

The majority of qualitative analyses that are performed in industrial laboratories are done by the *spectrographic* method. This is actually an extension of the simple flame tests mentioned above. In the flame of an ordinary Bunsen burner, about a dozen metals emit a characteristically colored light. In an oxygen-acetylene flame several more metals give such light. If the sample is subjected to more violent excitation in an electric arc or spark, all of the metals give characteristic emissions.

The unaided eye is very limited in its ability to identify a metal by the color of the emitted light for two reasons. In the first place, the color of one metal may obscure that of another. It was previously mentioned that the sodium flame obscures that of potassium. In the second place, the eye fails to distinguish between closely similar colors. For example, calcium, strontium, lithium, and rubidium all emit red light. Both of these difficulties are overcome by using a *spectroscope* to view the emitted light. This instrument separates the light into a spectrum consisting of different lines or bands. Each line has its own color, and each metal has several characteristic lines or bands. The potassium light can be observed even in the presence of more intense sodium light because it appears in a different part of the spectrum. Furthermore, the spectra of calcium, strontium, lithium, and rubidium are distinctly different from each other.

Even better than the spectroscope is the *spectrograph*. This instrument separates the emitted light into a spectrum and then photographs the spectrum. Each metal that was present in the sample is identified in the photograph by its characteristic system of lines and bands. The photograph can be filed as a permanent record of the analysis. Spectrographic methods require very expensive equipment and the services of a skilled operator. Furthermore, they are not applicable to most of the nonmetals.

The advantages of spectrographic methods are as follows: (1) With proper apparatus, they are much more sensitive than the ordinary wet methods. Many metals can be detected in amounts as small as 0.00000001 gram, some in amounts as small as 0.000000001 gram. (2) They are much faster. (3) The photograph frequently reveals the presence of an unsuspected metal for which tests would not have been made by the wet method.

One weakness of all the foregoing methods of qualitative analysis is that they yield information about the metals or the ions that are present in the sample but not about the compounds present. For example, when a sample consisting of sodium chloride and potassium sulphate is analyzed by a spectroscopist, he can report only that the sample contains sodium and potassium. A chemist, after analyzing the same sample by the wet method, can report that it contains sodium, potassium, chloride, and sulphate ions; but he is not able to state whether the sodium is present in the mixture as chloride or sulphate. *Microscopic analysis* enables him to answer this question. By examining the sample under the microscope, he can identify the constituents by the characteristics of their crystals.

X-ray analysis can also be applied to this problem. If a beam of monochromatic X-rays is directed at the sample and if the diffracted X-rays are photographed, the diffraction pattern is characteristic of the compounds in the sample.

Consult Hogness, T. R., and Johnson, W. C., *Qualitative Analysis and Chemical Equilibrium*, rev. ed. (New York 1940); Feigl, Fritz, *Laboratory Manual of Spot Tests* (New York 1943); Daggett, A. F., and Meldrum, W. B., *A Textbook of Qualitative Analysis* (New York 1946).

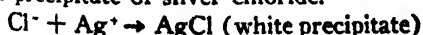
QUANTITATIVE INORGANIC ANALYSIS

The methods of inorganic quantitative analysis may be classified under three headings: gravimetric, volumetric, and instrumental.

In *gravimetric analysis*, the sample is usually dissolved, and some solution is added to react with and precipitate the element or radical to be determined. The precipitate is filtered, washed, heated to an appropriate temperature, and weighed. For example, if the percentage of calcium in a specimen of limestone is to be determined, the analyst weighs a sample, dissolves it in hydrochloric acid, adjusts the acidity, and adds ammonium oxalate. Under proper conditions, calcium oxalate monohydrate is precipitated, leaving in solution the magnesium, iron, and aluminum of the sample. He then filters and washes the precipitate, dries it at 105°C., and finally weighs it. From the weight of the precipitate, it is a simple matter to calculate the weight of calcium and hence the percentage of calcium in the sample.

Electrolytic analysis is a subdivision of gravimetric analysis in which the electric current is the precipitating agent. Consider the determination of the percentage of copper in brass as an example. The analyst weighs a sample and dissolves it in nitric acid. He inserts two pieces of platinum (electrodes) into the solution, one connected to the positive terminal of a storage battery, the other to the negative. A rheostat, a voltmeter, and an ammeter are connected in the circuit to facilitate the control of the current. Oxygen is liberated at the positive electrode and metallic copper is deposited on the negative electrode. By weighing this electrode before the determination and again after all the copper is deposited (usually about an hour), the chemist can calculate the weight of copper in the sample.

As an example of *volumetric analysis*, let us consider the determination of the percentage of sodium chloride in a mixture of sodium chloride and sodium nitrate. The analyst weighs a sample and dissolves it in water. He adds a small amount of potassium chromate. He next adds carefully from a buret a solution of silver nitrate whose concentration is accurately known. (This is called a standard solution.) The first portions of silver nitrate react with the chloride to form a white precipitate of silver chloride.



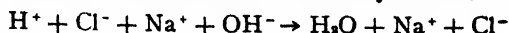
When all of the chloride of the sample has reacted thus, the next drop of silver nitrate reacts with the chromate to give a red-brown precipitate of silver chromate.



The chemist watches for this phenomenon and stops the addition of the silver nitrate as soon as he sees the red precipitate. He then reads the buret to find the volume of silver nitrate solution that has been used to react with the chloride. This volume, together with the known concentration of the silver nitrate, enables him to calculate the quantity of sodium chloride in the sample.

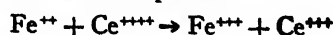
The fundamental process of volumetric analysis is the addition of a solution of known concentration to react with the element to be determined. This is called *titration*. For this reason, volumetric analysis is sometimes called *titrimetric analysis*. It is necessary to stop the addition of the standard solution as soon as the reaction is completed. For this purpose, a compound, called an *indicator*, is added to the solution of the unknown. The indicator causes a change in color when the reaction is complete, or at the *end point*.

The foregoing is an example of a volumetric determination based on a precipitation reaction. Volumetric methods may also be based on neutralization, oxidation-reduction, or complex-forming reactions. An example of a *neutralization* method is the titration of a solution of hydrochloric acid with standard sodium hydroxide.



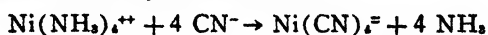
Phenolphthalein is a good indicator for this titration. It turns from colorless to red at the end point.

An example of an *oxidation-reduction* or *redox* method is the usual procedure for the determination of iron in an ore. The chemist dissolves a weighed sample of ore in hydrochloric acid, treats the solution with some reagent (perhaps metallic zinc) that reduces any ferric iron of the sample to the ferrous state, then titrates with a standard solution of a ceric compound.

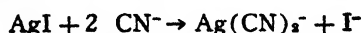


Phenanthroline serves as indicator, turning from pink to very pale blue at the end point.

An example of a *complex-forming reaction* is found in the determination of nickel in alloys. The chemist dissolves a weighed sample of alloy in acid, then adds ammonia. If iron or chromium is present, he adds citrate to prevent the precipitation of their hydroxides. The nickel is now present as the nickel-ammonia complex ion. Upon titration with potassium cyanide, it is converted to the cyanonickelate ion.



A small amount of insoluble silver iodide is used as the indicator. It is dissolved by a small excess of cyanide ion after the foregoing reaction is completed.



Thus the end point is marked by the disappearance of the turbidity due to silver iodide.

Volumetric methods are generally preferable to gravimetric methods because they are usually faster and more accurate. However, all chemical elements are not amenable to volumetric determination.

Instrumental methods of quantitative analysis have recently become very important. This term is generally used to include any method of analysis in which a reasonably complicated instrument, other than the balance and buret, is used.

The spectrograph, in addition to its use in qualitative analysis, can also serve for the quantitative determination of metals. Thus the appearance of two lines in the photograph corresponding to wavelengths of 589.6 and 589.0 millimicrons serves to indicate the presence of sodium in the sample. In addition, the intensity of these lines can be compared with the intensity of the same lines in the photographs obtained with

samples of known sodium content to find the content of sodium in the unknown sample. For the quantitative application of spectrography, all the experimental conditions such as the intensity of the excitation, the duration of the exposure, and the conditions for the development of the photograph must be the same for the unknown sample as for the standard samples. Even with these precautions, the spectrographic method is less accurate than gravimetric or volumetric methods except for the determination of trace constituents.

In contrast to spectrography, where the light emitted by the sample is measured, there are several analytical techniques that depend on the measurement of the light absorbed by the sample. These are called *photometric methods* or *colorimetric methods*. The essential feature is that the constituent to be determined must absorb light. If the absorption occurs within the range of visible wavelengths, the constituent is "colored"; but equally satisfactory photometric determinations of a "colorless" constituent can be performed if this constituent absorbs ultraviolet light. There is also the possibility of changing the constituent to be determined from a colorless to a colored form. For example, when manganese is determined photometrically, it is converted to the intensely purple permanganate ion.

In the simplest photometric procedures, the intensity of color of the solution of the unknown sample is compared visually with the intensity of color of standard solutions. In general, more satisfactory results can be obtained by using photometers. In these instruments, the solution to be investigated is placed between a steady source of light and a photoelectric cell, which measures the intensity of light that passes through the solution. From this measurement, the chemist calculates the concentration of the light-absorbing constituent. Monochromatic light is used in photometers. If a prism and slit are used to exclude all the wavelengths except the desired one, the instrument is called a spectrophotometer. If the undesired wavelengths are eliminated by passing the light through a colored glass, the instrument is called a filter photometer.

When light is passed into a suspension of a solid material in a liquid, some of the light is reflected or refracted into a path at right angles to the original beam. If this scattered light is measured with a photoelectric cell, we have a *photoelectric nephelometer*, which can be used to measure the concentration of the suspended solid. Nephelometry is frequently used to determine small traces of chloride after converting it to insoluble silver chloride. Nephelometry is less accurate than the photometric methods that depend on the absorption of light.

Fluorescent compounds have the ability to absorb light of one wavelength and to use the energy thus gained to emit light at a longer wavelength. The concentration of a solution of such a compound can be determined by measuring the intensity of the light emitted at right angles to the exciting beam. The *fluorophotometer* used for this purpose is very similar in design to the nephelometer.

Flame photometers are instruments for determining the concentration of those metals that emit light when introduced into a flame. The solution is atomized by a stream of air and swept into a flame. The light imparted by the metal is measured with a photoelectric cell. Interference

from other metals that color the flame can usually be eliminated by using a prism and slit or light filter to eliminate the undesired wavelengths. Very careful standardization is necessary if reasonable accuracy is to be obtained by this method.

In addition to the foregoing optical methods of instrumental analysis, there are numerous *electrochemical* methods. Many of these are adjuncts of volumetric analysis and serve merely to locate the end point in titrations.

In *potentiometric titrations*, two electrodes are inserted into the solution to be titrated. One is called a reference electrode and is usually a saturated calomel electrode. The other is called the indicator electrode. For redox titrations, the indicator electrode is platinum; for precipitation and complex-forming titrations, usually silver; for neutralization titrations, usually "glass" or "hydrogen." The analyst measures the electromotive force between the electrodes as the titration is performed. A sudden increase or decrease in this electromotive force marks the end point of the titration.

Instruments are now on the market in which the electromotive force at the end point activates a relay that turns off the buret. Thus the chemist is freed for other work during the actual titration. Aside from this rather novel aspect of potentiometric titrations, they possess two practical advantages over titrations with indicators: (1) In many cases they are capable of greater accuracy. (2) They can be used to titrate highly colored solutions where the color change of an indicator could not be observed.

In *conductometric titrations*, two electrodes of platinum black are immersed in the solution to be titrated, and the conductance (or resistance) of the solution is measured at several points during the titration. The conductance is plotted against the volume of titrating solution added. A sudden change in the direction of the graph marks the end point. Conductometric titrations are less accurate than indicator or potentiometric titrations except in the titration of very weak acids. They are useful for colored solutions and for those titrations for which there are no satisfactory indicators or indicator electrodes.

An alternating current of about 1,000 cycles per second is ordinarily used in conductometric titrations. If the frequency is increased to about 1,000,000, the technique is called *high-frequency titration*. Then the electrodes can be placed outside the solution on opposite sides of the containing beaker. The curves have different shapes, but the end points are still marked by a sudden change in direction. The theory of high-frequency titrations is not well understood, but the dielectric constant of the solution as well as its conductance enters into the measurements.

Polarographic analysis is one of the important electrochemical techniques. Mercury is allowed to drop from a reservoir through a capillary tube that is immersed in the solution to be analyzed. The rate is controlled at about 20 or 30 drops per minute. The dropping mercury is made the negative electrode, while the pool of mercury that collects in the bottom of the vessel, or preferably a saturated calomel electrode, is the positive electrode. The electromotive force between the two electrodes is gradually increased, and the current flowing through the solution is read at frequent intervals. A graph is plotted showing the relationship of the current to the electromotive force. This graph ordinarily shows a sudden

steplike rise for each reducible constituent of the solution. The rise caused by any particular reducible solute always occurs at the same electromotive force. The height of the rise is proportional to the concentration of the solute being reduced. Thus the graph serves to determine the concentration of the solute in question. Polarographic methods are less accurate than volumetric or gravimetric methods except for the determination of trace amounts. In *amperometric titrations*, the polarographic technique is used to locate the end point.

Radioactive isotopes are sometimes used in testing the accuracy of a method, in locating the sources of error in a method, and in performing rather unusual determinations. Their use in routine analysis is limited by the precautions and special techniques that are required.

The accuracy of inorganic quantitative analysis varies greatly with the constituent to be determined and the presence or absence of interfering constituents in the sample. A skilled analyst can determine the percentage of copper in brass by the electrolytic method with an error smaller than 0.1 per cent. On the other hand, the gravimetric determination of the percentage of silica in limestone, clay, glass, or refractory is subject to errors of several tenths of one per cent.

Consult Kolthoff, I. M., and Sandell, E. B., *Textbook of Quantitative Inorganic Analysis* (New York 1941); Dean, J. A., Mettrick, L. L., Jr., and Willard, H. H., *Instrumental Methods of Analysis* (New York 1948); Rieman, W., Neuss, J. D., and Naiman, B., 3d ed. (New York 1951).

QUALITATIVE ORGANIC ANALYSIS

The purpose of the qualitative analysis of an organic substance may be to identify the elements or the compounds present in the sample. If the former objective is sought, the organic substance is decomposed so that inorganic compounds of the constituent elements are formed. This may be accomplished by heating some of the unknown with metallic sodium. Thus sodium cyanide, sulphide, and chloride are found if the unknown contains nitrogen, sulphur, and chlorine, respectively. Ordinary inorganic qualitative tests are then used to identify the products of the decomposition.

The identification of the compound or compounds in the sample is a more difficult task. If the sample has a constant boiling point and melting point, it probably contains only one compound. Then the analyst's task is to identify this one compound as one of the many thousands of known organic compounds. The sample is classified into one of the groups of organic compounds by noting its solubility in water and in various aqueous solutions, also its reactions with reagents such as bromine, alcoholic silver nitrate, acetyl chloride, nitrous acid, and phenylhydrazine. Finally the measurement of its physical properties such as density, refractive index, boiling point, and melting point serves to identify the compound.

If the sample is a mixture of two or more compounds, the task is more involved. It is first necessary to separate the compounds from each other. This may be accomplished by taking advantage of differences in their boiling points (by fractional distillation) or differences in their solubilities (by extraction or fractional crystallization). Finally, the isolated and purified compounds are identified as outlined above.

Consult Fuson, R. C., and Shriner, R. L., *The Systematic Identification of Organic Compounds*, 2d ed. (New York 1940).

QUANTITATIVE ORGANIC ANALYSIS

If a quantitative ultimate analysis is desired, the *combustion method* is generally applied. For the determination of carbon and hydrogen, a weighed sample contained in a porcelain or platinum boat is put into a tube of silica or high-melting glass. Oxygen is passed into the tube, and the sample is heated. The tube also contains cupric oxide to aid in the oxidation. Thus the carbon of the sample is converted to carbon dioxide and the hydrogen to water vapor. If the sample contains compounds of chlorine, sulphur, or nitrogen, lead dioxide is also put into the tube to retain these elements as lead chloride, sulphate, and nitrate. Thus the gases issuing from the other end of the tube contain only water vapor, carbon dioxide, and excess oxygen. These gases are passed first through a weighed tube containing anhydrous magnesium perchlorate or other drying agent, then through a weighed tube containing solid sodium hydroxide. The first tube absorbs the water, and the second tube absorbs the carbon dioxide. The gain in weight of these tubes is a measure of the hydrogen and carbon, respectively, in the sample.

For the determination of chlorine and sulphur, a different type of combustion tube is used in which hot platinum acts as a catalyst for the oxidation, replacing the cupric oxide. The gas issuing from such a tube contains the chlorine as hydrogen chloride and the sulphur as sulphur trioxide. These substances are absorbed by passing the gas through suitable solutions, and then determined by an ordinary gravimetric or volumetric method.

Nitrogen in an organic sample may be determined by the Kjeldahl method or by the Dumas method. The *Kjeldahl method* is the simpler procedure and yields accurate results unless the nitrogen is present as nitrile groups or in heterocyclic compounds. In this method, the weighed sample is heated with concentrated sulphuric acid. Thus the nitrogen is converted to ammonium ion, which is determined by a neutralization titration.

In the *Dumas method*, the weighed sample is mixed with cupric oxide and heated in a tube containing both cupric oxide and metallic copper. The nitrogen is converted to elementary nitrogen, a gas. This is swept from the combustion tube by passing carbon dioxide through the tube. The effluent gases are bubbled through a solution of potassium hydroxide, which absorbs the carbon dioxide. The residual volume of pure nitrogen is measured.

Although several methods have been proposed for the determination of oxygen in organic substances, none is entirely satisfactory or widely used. The usual method for this determination is to find the percentages of all other elements in the sample and to subtract the sum from 100.

Ultimate organic analysis is frequently done on the micro scale. For details consult Niederl, J. B., and Niederl, Victor, *Micromethods of Quantitative Organic Elementary Analysis* (New York 1938).

The determination of the percentage of one compound in a mixture of organic compounds is ordinarily a difficult task. Space will permit only the brief mention of a few of the possible approaches to this problem.

If the sample to be determined is an acid or a base and if interfering acids or bases are not present, a simple neutralization titration will suffice. This may often be profitably performed in

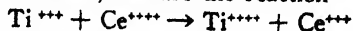
some organic solvent rather than in water. Titration with an oxidizing agent such as a ceric compound may be successful in the determination of a reducing compound if other reducing agents are not present in the sample. Titration with a reducing agent such as titanous sulphate is used to determine nitro compounds and some dyestuffs. Iodic acid reacts only with compounds that contain hydroxyl groups on two adjacent carbon atoms and can be used for the determination of such compounds.

Photometric methods are often applicable. Infrared photometry is also used. Some organic compounds such as nitro compounds and aldehydes can be determined polarographically. Sugars and some other organic compounds have the property of rotating the plane of polarized light, the degree of rotation being proportional to the concentration. Thus a measurement of this property with a *polarimeter* can be used to determine such a compound provided that other compounds with this property are not present in the sample.

Volatile samples may be analyzed by the *mass spectrometer*. A small amount of the sample is admitted into an evacuated chamber and bombarded there with a stream of electrons. These decompose the compounds into charged fragments (ions). A large velocity is imparted to these fragments by an intense electrical field. As these ions sweep through the tube they are subjected to a magnetic field at right angles to their motion. This deflects them from their original direction, and the light ions are deflected more than the heavy ones. Thus the spot on the end of the tube which a given ion hits depends on its weight. By measuring the number of ions that hit different points, the quantity of ions of any given weight can be determined. These data permit the operator to calculate the composition of the sample. This technique is very important in the analysis of gasoline.

ANALYTICAL SEPARATIONS

In any quantitative analysis, whether the sample is organic or inorganic, whether the final determination is to be done gravimetrically, volumetrically, or instrumentally, the analyst is liable to encounter the difficulty of finding in the sample some constituent that interferes with the determination of the desired constituent. For example, in the electrolytic determination of copper, silver would be deposited on the negative electrode along with copper and hence would interfere. Again, the presence of titanium introduces an error in the volumetric determination of iron, as previously outlined, because the reaction



would also occur during the titration. In some cases the interference can be avoided by selecting a different method of determination. For example, aluminum interferes in the gravimetric but not in the volumetric determination of iron. In other cases the analyst has to remove the interfering constituent before the determination can be performed. A brief description of the methods for such separations follows.

Distillation and extraction, which have already been mentioned as methods of separating organic compounds, are also used in inorganic analysis. Boron is frequently separated from interfering elements by distillation. Iron can be separated from most other cations by shaking the aqueous solution containing hydrochloric acid with isopropyl ether. The ferric chloride dissolves in the

ether, leaving the other metals in the aqueous solution.

The *precipitation* of a single compound or of groups of compounds is frequently used for separations but is seldom entirely satisfactory. The precipitate is always contaminated with the compounds or ions that would normally remain in solution under the given conditions. This phenomenon is called *coprecipitation*.

Electrolytic separations are simple and effective in some cases. If the solution is electrolyzed with a platinum anode and mercury cathode, metals such as lead, cadmium, copper, and silver are dissolved in the mercury while the ions of other metals such as calcium, magnesium, and sodium remain in the aqueous solution.

Chromatographic methods have recently been used to accomplish some very difficult separations. In *adsorption chromatography*, a vertical tube, open at both ends, is filled with a solid adsorbent, frequently alumina. The substances to be separated are dissolved in a small volume of some solvent, usually nonaqueous, and poured into the tube. Additional solvent is slowly poured into the tube. The solutes usually have different affinities for the adsorbent, so that they move down the tube at different rates and issue from the tube in different fractions of the effluent.

The procedure of *partition chromatography* is analogous except that the tube is usually filled with moist starch or silica gel and the separation is achieved by pouring an organic solvent through the tube. In *ion-exchange chromatography*, the tube is filled with an ion-exchange resin. The sample is added in aqueous solution, and the liquid used to cause the separation is an aqueous solution of a suitable salt. In *paper chromatography* one small drop of a solution of the substances to be separated is placed on a strip of paper. Liquid is allowed to trickle slowly down the vertically held strip, thus separating the solutes.

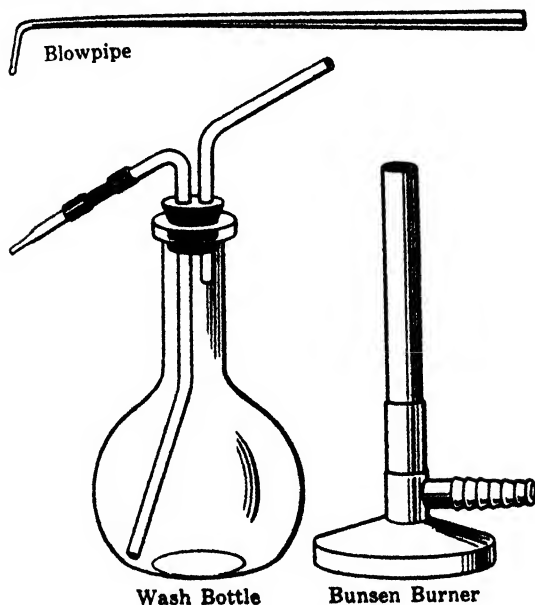
WILLIAM RIEMAN III,
Professor of Analytical Chemistry, Rutgers University.

CHEMICAL APPARATUS. To gain a general idea of chemical laboratory apparatus and equipment, the reader is asked to join an imaginary tour of a large university laboratory.

The Beginners' Laboratory.—The first door that is opened admits to a room in which a class is beginning the first laboratory exercise of the elementary course. The students are distributed along *laboratory tables* or *desks*. These desks have tops of soapstone or acid-proof wood below which are drawers and cabinets in which apparatus is stored. Above the tops are narrow shelves for *bottles* containing chemicals in constant use. Beneath the bottle racks are pipes for water and gas, and conduits for electrical wiring. *Sinks* of stoneware are set into the desk tops at intervals. Along the walls are several tables on which are placed cabinets of asbestos board and glass sash connected with ventilating ducts. These are the *hoods* through which fumes are removed. The remaining wall space is lined with shelves filled with bottles of several types. Those containing liquids have relatively small necks and are closed by glass stoppers, by plastic screw caps, or by rubber stoppers. Those filled with solids have larger necks. All bottles in permanent use have either enameled labels fused on them or raised letters and figures cast as the bottle was made.

The task in which this group of students is engaged is the making of a "wash bottle." A *Florence flask* is best adapted to this purpose. It has a fairly long neck and a flat bottom, but its general shape is globular. A glance into an open desk will reveal several *Erlenmeyer flasks* with flat bottoms and walls that taper from the greatest breadth at the bottom up to a short neck. The *round bottom flask* more commonly employed in advanced courses is somewhat less likely to break when heated, but must always be supported by rings or clamps when in use.

The student is supplied with a collection of *rubber stoppers*, and selects one of the proper size which is made with two holes through it. For certain uses it is necessary to start with a solid rubber stopper or with a *cork stopper* and bore the desired holes. A *cork borer* is essentially a brass tube with a handle at one end. The other end is beveled to a sharp edge and the hole is made by pressing and twisting the borer through the stopper. If a hole is being made through rubber, the borer is moistened with water. An experienced manipulator will bore

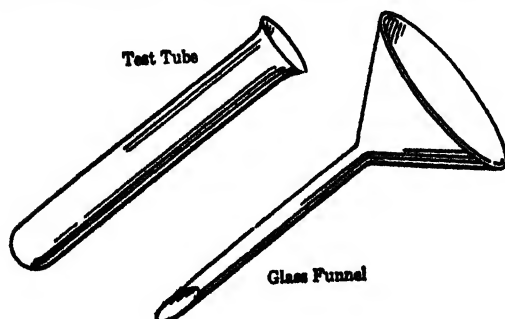


only part way from one end of the cork, and then will start the hole from the other end and so gauge distances that a smooth hole results. The plug that is removed has to be pushed out of the borer by a rod. The next step is to cut, bend, and draw *glass tubing* to the proper shape and dimensions. Glass tubing is furnished in lengths up to about five feet and must be cut to shorter lengths. This is done by making a light mark with a *triangular file* at the proper point and applying gentle pressure on each side of the mark. The edges at the break are sharp and must be rounded by holding the ends of the tubing in a gas flame until the glass softens. The gas flame is from a *Bunsen burner*. This is essentially a metal tube held in a base of some sort into the lower end of which a stream of combustible gas enters through a small orifice regulated by a valve. Air is admitted at the same time through holes in a collar around the tube, which is similarly perforated. The air serves to cool the interior of the flame and to prevent the premature decomposition of some of the components of the

gaseous fuel with the formation of incandescent carbon particles. (A still hotter flame is produced by admitting air or oxygen under pressure in a *blast lamp*.) The flat shape of the flame employed in drawing and bending glass results from a flattened *wing tip* which is temporarily attached to the top of the burner. One piece of glass is heated and drawn so that the two portions of normal diameter are connected by a constricted portion. By cutting in the middle of the constriction, a tip for the wash bottle is obtained. Two other pieces of glass are bent in the flame, one to an acute and the other to an obtuse angle. The former is of sufficient length to reach nearly to the bottom of the flask, while the portion of the other that is beyond the bend is only long enough to extend part of the way into the neck of the flask. The two pieces of glass are wetted with water and gently forced through holes in the rubber stopper. The tip is attached to the tube coming from the bottom of the flask by a piece of *rubber tubing*, and the wash bottle is ready to be filled with water or other liquids. To cause water to flow from the bottle, the user blows into the tube with the obtuse angle. Water rises in the other tube and escapes through the tip. Since this is connected with a flexible rubber tube, the stream of water may be directed where it is needed.

Detection and Identification of Substances.

—The visitor next comes to another laboratory where students are detecting and identifying various substances. Here is a student who has just received from his instructor a small stoppered flask containing a clear liquid. Some of this is poured into a *test tube*, which is merely a thin-walled glass tube with one rounded closed end and a small flaring lip at the other end. Several of these tubes are in a wooden *test tube rack* on the desk. To the liquid in the tube the student adds a few drops from a reagent bottle. The contents of the tube change in appearance to resemble milk. The tube is picked up by a *holder*, which is made of heavy wire so bent that when the handle portion is squeezed the wire loops functioning as jaws open, and when pressure is released the jaws hold the tube tightly. By means of this holder the tube may be placed in the upper portion of the flame from a Bunsen burner, this time without the wing tip. If the tube were held upright, the steam generated at the bottom would throw out the liquid above it. It is properly held in a slanting position and heat is applied a little below the upper surface of the liquid. As heating is continued, the milky appearance of the liquid changes, and there is definite separation of solid and liquid portions. The student has previously placed a *glass funnel* with a long stem in another test tube. Into this funnel he has folded a piece of circular *filter paper* so



that it forms a cone fitting the funnel closely. The contents of the first tube are poured slowly into the funnel. The solids remain on the paper, and a clear liquid runs out of the stem of the funnel.

This operation of filtration may be modified in a number of ways. A small porcelain *filter disk* may be laid in the funnel and its perforations covered with a small disk of filter paper. Instead of depending on gravity, the funnel may be passed through a rubber stopper and placed in the neck of a *suction flask* the side arm of which is attached to a *vacuum pump*. Thus the pressure of the atmosphere forces the liquid through the filter medium. For separation of larger quantities of solids, the *Büchner funnel* functions in much the same way as a funnel and a disk, being a porcelain funnel with a perforated disk permanently sealed in it.

Another student has gone to a hood, attached a short length of glass tubing to a *Kipp generator*, and is passing a slow stream of gas through a liquid in a test tube. This gas generator appears at first glance to be made up of three superimposed bulbs, the lowermost one having a flattened base, and the uppermost having a neck like that of a flask. Closer examination reveals that the uppermost bulb terminates in a long tube that reaches almost to the bottom of the apparatus. The middle and lowermost bulbs are connected by a short cylindrical section through which the tube from the topmost bulb passes. Lumps of a solid are packed around the tube in the middle bulb, but are not small enough to pass through the annular space between the tube and the constricted section between the two bulbs. There is a gas outlet equipped with a valve in the upper part of the middle bulb. A liquid fills the bottom bulb and partly covers the solids in the middle bulb. Chemical action produces a gas, which escapes through the valve. When sufficient gas has been drawn off to complete the test, the valve is closed. Gas pressure forces the liquid up the tube into the upper bulb until it is drained from the lumps of solid. Chemical action then ceases and the generator is ready for use again.

Still another student is testing a solid substance by heating it in a depression in a lump of charcoal by means of a *blowpipe*. This is merely a metal tube with ring lip at one end and a small jet orifice at the other. A tip somewhat similar to the wing tip is placed on top of the Bunsen burner, the chief difference being that it has a slanting orifice. The blowpipe is placed just outside or within the flat flame, depending on the chemical action desired, and a steady jet of flame is directed against the substance on the charcoal. This requires some skill on the part of the operator. The cheeks are continually inflated so that breathing does not interfere with a continuous blast of air through the blowpipe.

Organic Preparations.—In the next room chemical compounds are being made in larger quantities. Here is a preparation in its first stage. Substances have been mixed together in a round-bottomed flask and are now in solution. The flask rests on a square of *wire gauze* supported by a *ring* the side rod of which is held by a *clamp* to the upright rod of a *ring stand* base. The flask is being heated by a burner of the same type as those previously seen. Flasks are often supported on *tripods*, which are rings fitted with three legs. Projecting through a stopper into the neck of the flask is a *condenser*, which is being operated

in the "refluxing" position. A condenser is essentially a long glass tube tapering slightly at the lower end and flaring into larger diameter at the upper end. Around the central portion of this tube is another larger tube held at its constricted ends by pieces of rubber tubing to form a jacket around the inner tube. In many condensers this jacket is permanently sealed on the inner tube by the fusion of the glass. Water flows into the jacket through a tube sealed on near its lower end and escapes through another side tube near the upper end. The water is fed in and escapes through rubber tubing. The contents of the flask are boiling briskly, and the vapors pass up into the cooled inner tube of the condenser. There the lowered temperature converts them to a liquid again, which drops back into the flask.

Another worker has gone still further with this preparation and is now pouring the cooled liquid from the flask into a *separatory funnel*. The upper part of this piece of apparatus resembles a round flask with a short, glass-stoppered neck, the lower part an ordinary funnel with a valve connecting it with the stem. Another liquid is poured into the separatory funnel, and it is seen that the two liquids do not mix. The stopper is put in, the funnel is inverted, and any gas that has formed is vented through the stem. Then the funnel is thoroughly shaken and set upright in a ring on a stand. When the contents separate into two layers, the lower layer is drawn off, the stopper being removed to permit entrance of air. The purpose of this operation is to extract a substance from the first liquid by means of a second liquid in which it is more soluble and in which other substances in the first liquid are not appreciably soluble.

Final purification of the substance desired is brought about by distillation. The simplest apparatus for this purpose is a *distilling flask* an ordinary round-bottomed flask with a long neck to which an inclined side-arm tube is sealed. A *thermometer* passes through a stopper and is so adjusted that its bulb is just below the side-arm tube. This tube passes through a stopper into the upper end of a condenser, which this time slopes downwards. The lower end of the condenser passes into a receiving flask. The whole apparatus is supported by ring stands and clamps. As the impure liquid is heated, the vapors of the pure material rise, pass through the condenser, and are converted to a liquid, which drips into the receiver. The thermometer reading indicates the boiling point of the pure liquid. This represents the most elementary form of distillation. If a mixture of two liquids of different boiling points is to be separated, a *distilling column* is employed. This may either be the very long neck of the flask or a tube attached to the flask. Its inner surface is greatly increased by being filled with beads, bulbs, or coils of wire. A certain portion of the vapors is condensed and returned as "reflux." In this way the higher-boiling material is returned to the flask, while the more volatile liquid escapes into the final condenser.

A *Claissen flask* is often substituted for the ordinary type of distilling flask in vacuum distillation of liquids of high boiling point that tend to decompose at higher temperatures. This flask has a round bottom and a short neck which branches into two vertical tubes or necks. One is a continuation of the original flask neck, while the other is connected at a right angle and is then bent again to a vertical position. The delivery

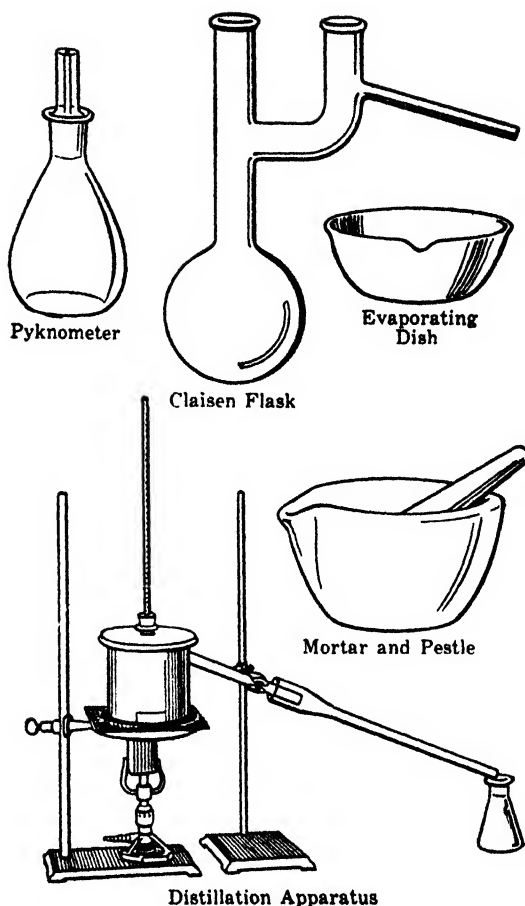
tube is on this second neck, which also contains the thermometer. A glass tube, drawn at the end to a fine capillary, passes down through a rubber stopper in the first neck nearly to the bottom of the flask. A fine stream of air bubbles, drawn in by the vacuum through this tube, serves to keep the liquid stirred and boiling smoothly.

For many purposes a simple injector attached to the water supply suffices as a vacuum pump. For lower pressures a motor-driven *oil pump* equipped with vanes or gears is necessary. Many laboratories have a system of piping which leads to a large pump that provides vacuum service all over the building.

Instead of employing a direct flame under a wire gauze or a *sand bath* (a flat pan containing a thin layer of sand), heat may be applied through boiling water in a *water bath* (a pan with a top made up of concentric rings to fit the flask used), or a *steam bath* (a funnel with similar type of top and fed with steam). Electric resistance heaters, either with flat tops or with depressions that fit the proper flask, are also commonly employed in such laboratories. Another type of *flask heater* is a globular bag of woven glass thread equipped with a zipper and containing imbedded resistance wire for electric heating.

Quantitative Analysis—Gravimetric.—The next laboratory is devoted to the determination of the quantities of substances that are present in synthetic or natural products. Just now the class is analyzing a rock, and the quantity of silica in it is being determined. One worker is grinding a sample of the rock to a fine powder in a *mortar* by means of a *pestle*. The mortar is a thick-walled, shallow vessel made of agate. Ordinary mortars are somewhat deeper and are made of some sort of porcelain ware. The pestle is essentially a thick and slightly tapering rod with rounded ends, and is of the same material as the mortar. Soft materials may be ground with mortar and pestle alone, but harder rocks must be handled in special grinding equipment of alloy steel until small particles result. Grinding is continued in a mortar until the powder passes through a fine-mesh *sieve*.

A portion of the powder is then weighed on an *analytical balance*. This piece of equipment is necessary in all analytical laboratories. In common with the crudest of weighing devices it is made up of a beam suspended at its middle point and two pans flexibly attached to the ends of the beam. The analytical balance, however, is much more complicated and delicate. The beam is supported by a steel or agate knife edge on a plate of similar material which is at the top of a vertical post. The pans hang from stirrups which are equipped with knife edges and plates. The beam has a long vertical pointer which reaches down to a graduated scale at the base of the post supporting the beam. Supports lift the beam and the pans when the balance is at rest, and can be lowered gradually during weighing operations. This enables the operator to ascertain which pan is more heavily loaded, and to adjust weights until the two pans are almost evenly balanced. Then the beam is allowed to swing slightly and the deflections of the pointer are noted on the scale. The larger *weights* are brass cylinders with stems, and are often plated with nickel, platinum, or gold. The smaller weights are thin square plates with an upturned edge or corner, the more expensive ones being made of platinum. Weights are not touched by



the hands, but are handled by brass *forceps* tipped with bone or plastic material. Final adjustment is made by placing a *rider* on the graduated beam and moving it to the proper position as indicated by the deflections of the pointer. A rider is a piece of aluminum or platinum wire with a loop in the center and two downward sloping ends. It is handled by means of a sliding hook. The entire mechanism is enclosed in a glass case with sliding doors. The usual chemical balance has a capacity of 200 grams and can detect differences of .0001 gram or .1 milligram. Special types of balances such as those used in assaying and in micro-analysis are still more delicate and sensitive.

The sample of material to be analyzed is either placed in a glass-stoppered, thin-walled weighing bottle from which necessary amounts are removed, or it is spread on a *watch glass*, a shallow glass dish of the shape of a watch crystal. To avoid additional weighings, it is common practice to balance one watch glass with another of exactly the same weight on the other pan of the balance, the weights being laid on the glass rather than on the balance pan. Portions of the sample are added or removed from the watch glass by means of a *porcelain spoon* or a *stainless steel spatula*. A spatula is a flat blade with rounded ends and a handle.

The weighed sample is dried in an *oven* heated by burning gas, or more commonly by an electric current. The latter type of oven can be more accurately controlled, expanding and contracting metal contacts turning off and on the current to maintain the temperature between the

desired limits. To avoid absorption of moisture on cooling, the sample and its container are placed on a perforated plate in a covered vessel called a *desiccator*. Below the plate there is a substance such as sulphuric acid, calcium chloride, or phosphorus pentoxide, which absorbs water vapor.

In order to render the sample of rock powder soluble, a weighed amount is mixed with sodium carbonate and fused in a platinum *crucible*. The usual crucible has a flat bottom, circular cross section, and curved sides, and is fitted with a lid that has a short projection at one side for a handle. Crucibles are handled by *tongs* of brass or nickel, some being shod with platinum at their tips. The fused mass is cooled and dissolved in an acid solution, the crucible and its contents being placed in a *beaker*. A laboratory beaker is a thin-walled cylinder with a flat bottom that curves at its edges to join vertical walls. It is commonly somewhat deeper than it is wide, is flared slightly at the top, and at one point on the rim has a small lip like that of a pitcher to facilitate pouring. A beaker is usually covered by a watch glass. A thin glass *stirring rod* with rounded ends is placed in the beaker so that it projects from under the cover glass through the lip. Heating is accomplished on a wire gauze above a burner or on an electrically heated plate. The crucible is removed, when solution is complete, and is washed by a stream of water from the wash bottle, being handled by the stirring rod. The solution of the sample is transferred to a shallow *vaporating dish* with a rounded bottom and a pouring lip. In the analytical laboratory such dishes are often made of platinum, but for most purposes porcelain dishes are satisfactory. Evaporation is accomplished in this case in a water bath. Evaporation is often carried out in a deeper dish that is called a *casserole*, a term familiar to housewives. The dry residue in the dish is moistened with acid and is again dried on the water bath. After the addition of water, the silica is obtained in the form of a jelly-like solid. The contents of the dish are poured into a funnel lined with filter paper, the lip of the dish being held against a stirring rod which is placed vertically over the funnel. A constriction in the stem of the funnel accelerates the speed of filtration by permitting the formation of a column of liquid in the lower part of the stem.

After the removal of as much as possible of the suspended solid to the funnel by a stream from the wash bottle, a rubber-tipped rod called a *policeman* is rubbed over the inside of the dish to loosen any adhering material, and this is in turn washed out of the dish. The funnel is held in a rack or *funnel stand*, which is often made of wood. The liquid which passes through the paper is caught in a beaker.

When the solid substance on the filter paper has been washed free of dissolved material, the paper and its contents are transferred to a weighed porcelain or platinum crucible. The paper is dried and burned as the crucible is suspended over a flame in a *wire triangle*. If the wire is of iron, it is usually protected by tubes of fireclay or fused silica, but platinum and nickel-chromium triangles do not require such protection. The crucible may also be placed in an *electric furnace* lined with fireclay and heated by resistance coils. After the paper has burned, leaving a negligible amount of ash, and all water has been driven off, the crucible is cooled down to about the temperature of boiling water and

is placed in a desiccator to be further cooled. The weight of the contents of the crucible is obtained and recorded. This is a typical gravimetric determination.

Precipitates that need to be heated only to moderate temperatures in an oven may be handled in a *Gooch crucible*. This has uniformly and slightly sloping walls and a perforated flat bottom. It is attached by means of a short piece of rubber tubing to a glass tube whose constricted lower end passes through a rubber stopper into a suction flask. A suspension of asbestos fibers in water is poured into the crucible as suction is applied until a thin filter mat is formed, which will retain most precipitates satisfactorily.

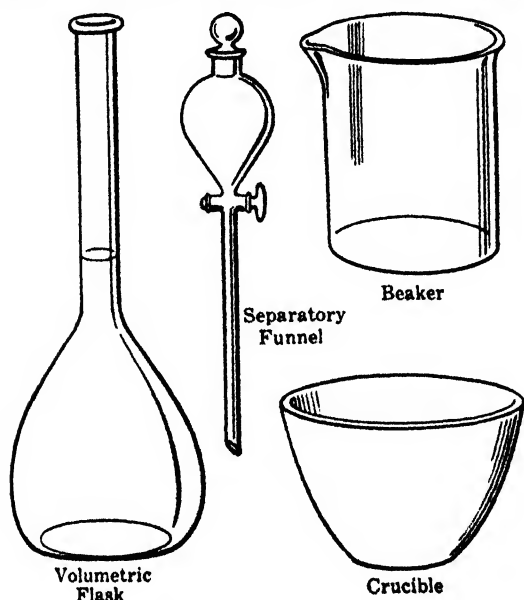
Quantitative Analysis—Volumetric.—Passing on to another laboratory, also devoted to analytical work, the visitor will see tests made by the measurement of liquids. An exactly weighed amount of a compound is dissolved in water and is transferred to a *volumetric flask*. This resembles a Florence flask, but has a longer and thinner neck and is equipped with a glass stopper. On the neck is an etched ring which indicates that when the flask is filled exactly to this mark, it contains a certain definite amount of liquid. The weight of the dissolved material is known, and when water is added until the mark is reached, the volume of the solution is known (For many purposes liquids may be measured in a *graduated cylinder*, but in analytical work more accurate methods are required.)

Smaller portions of such a solution are delivered from a *buret*. This is a long glass tube to which is attached a glass valve known as a stopcock and a tip drawn out so that the liquid will flow out drop by drop or in a very thin stream depending on how far the valve plug is turned. The tube has graduations, beginning shortly below the top and extending down nearly to the stopcock, which indicate how much liquid has been drawn off. A typical buret has a capacity of 0.5 liter or 50 milliliters between the uppermost and lowermost marks, and it is possible to read and estimate to .01 milliliter. A *pipette* is a small tube with an enlarged section about midway between the two ends, the lower end being constricted at its tip. A mark on the upper end of the pipette indicates its capacity when filled by suction to this mark. Safety regulations forbid direct mouth suction on filling pipettes unless the liquids are harmless. It is common practice to draw liquid in somewhat above the mark and allow it to run out until the level sinks to the mark. The rate of flow is controlled by placing a finger above the upper end, lifting and pressing as required. Pipettes are generally used to deliver a fixed amount of liquid, although some are of uniform bore and are graduated like a buret.

In a volumetric analysis a weighed amount of substance dissolved in some liquid or a measured volume of liquid in a dish, flask, or beaker is placed under a buret and the testing liquid of known concentration is run in with stirring until there is a definite change of color in the mixed liquid. Instead of depending on a change of color, many determinations are made by adding the testing liquid in small portions and, after each addition, measuring the voltage that is set up between the liquid in the container, into which an electrode dips, and another half cell of known value. The two half cells are connected by means of a solution in an inverted U-tube dipping below the surfaces of the liquids in the two. Such de-

terminations require the use of a complex piece of electrical equipment known as a *potentiometer*.

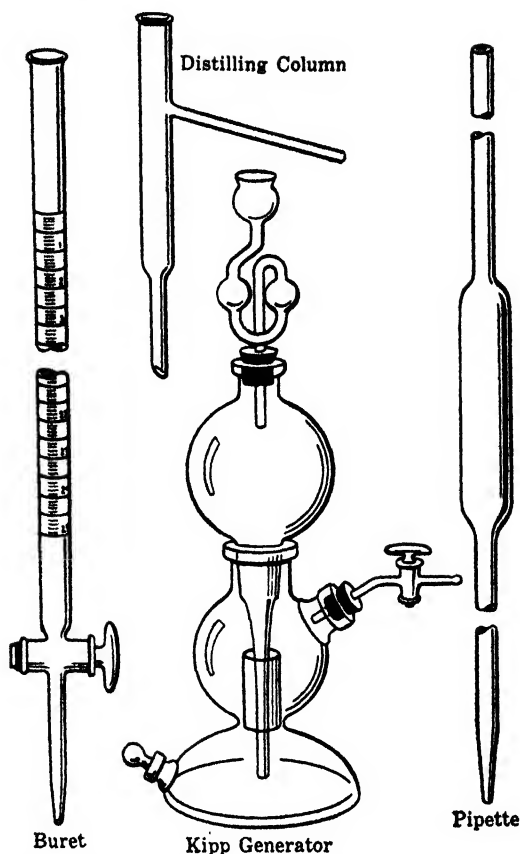
The substances present in a gas are commonly determined by measuring the shrinkage in volume of a sample of the gas as one substance after another is removed from it as it is passed over absorbing solutions in *gas pipettes* and back into a *gas buret*. The quantity of certain gases evolved as the result of reactions between the weighed sample and appropriate chemicals is often accurate measures of the amounts of substances that are being determined. Quite often the quantity of a gas absorbed is determined by weighing the absorbing vessel before and after passage of the gas through it. Carbon compounds are commonly analyzed by burning them in a hard glass or silica tube in a *combustion furnace*, usually electrically heated. A current of oxygen sweeps the products of combustion through a weighed *absorption bulb* which retains them and permits the escape of unused oxygen.



This method is employed in the rapid determination of carbon in steel.

Special Types of Equipment.—A great many special types of equipment are found in chemical laboratories, each type having a specific and definite purpose. For example, one collection of tubes, stirrers, cooling bath, and thermometer makes up a *freezing point apparatus*. A somewhat similar assembly with heating facilities and condenser constitutes a *boiling point apparatus*. By weighing a bottle of special shape fitted with a long, perforated glass stopper and known as a *pycnometer*, filling it with liquid, forcing out the excess of the liquid by inserting the stopper, wiping it dry, and weighing it again, it is possible to determine the exact density of the liquid. The capacity of the bottle is found by filling it with a liquid of known density such as water.

Instruments are increasingly important in chemical laboratories, and this is particularly true in industrial work. The refractive index is a measure of the extent to which a beam of light is bent as it passes through a transparent substance. This is a property of each individual substance by which it may be identified and es-



timated, measurement being made by a *refractometer*. Certain substances twist the plane of vibration of polarized light as it passes through them. The extent of rotation is measured by a *polarimeter*. In the sugar industry the instrument is graduated to read directly the percentage of sugar and is called a *saccharimeter*. The extent to which light is obscured in its passage through a suspension of finely divided solids may be measured by a *nephelometer* and the results indicate the quantity of solids present. A *colorimeter* measures quantities of colored material by comparison with known standards. The light from solid substances that are heated to incandescence, when passed through a prism, is broken up into a series of lines, which may be photographed and thus recorded. The instrument in which this operation is carried out is a *spectrograph*. It not only detects various elements but gives a fair idea of their quantities. The crystalline form and optical properties of solids are observed and determined by the *microscope* (q.v.). These are typical instruments employed in a chemical laboratory.

Many of the operations described are duplicated on a larger scale in the chemical engineering laboratory or in the semiworks or pilot plant of an industry. However, the equipment employed is often quite different and resembles more closely that of a large plant. In many cases larger equipment accomplishes results that are difficult or impossible in laboratory apparatus. For example, a large, bubble-cap, fractionating tower can bring about separations of two liquids whose boiling points are close together much more efficiently than can laboratory distillation equipment.

The visitor may gain a final impression of the scope and variety of laboratory apparatus by going through the stockroom of a chemical laboratory. An inventory of the shelves and bins will show hundreds of different types of equipment of many sizes. As many as 30 kinds of equipment will be found in the locker of a student in the first-year course, while in the research laboratory the number and variety of articles is very much greater.

For further information the reader is referred to the catalogues of scientific equipment companies, which may be found in school and college laboratories, and to the following books: Morton, A. A., *Laboratory Technique in Organic Chemistry* (New York 1938); Child, E., *The Tools of the Chemist—Their Ancestry and American Evolution* (New York 1940). All illustrations courtesy Eimer and Amend, N. Y.

W. T. READ,

Chemical Adviser, General Staff, Department of the Army.

CHEMICAL CRYSTALLOGRAPHY is concerned with the relations between the chemical constitution of crystallized substances and the structure of the crystals as revealed by their form and physical characters.

Consciousness of the specific relation between crystal structure and chemical constitution followed on the development of knowledge of crystal shape on the one hand and chemical composition on the other, toward the end of the 18th century, and culminated in the suggestion by René Just Haüy in 1800 that "to every specific substance of definite chemical composition capable of existing in the solid condition there appertains a crystalline form peculiar to and characteristic of that substance." By crystalline form we are to understand, not the precise shape of a crystal in all details, for the relative overall dimensions of a crystal and the relative areas of the faces are variable and depend on crystal growth conditions, but the shape of the unit of internal structure as indicated by the interfacial angles, which are constant for any one crystalline substance at a given temperature. Later studies have confirmed the soundness of this generalization, and contributed interesting amplifications.

Thus Eilhardt Mitscherlich in 1821 observed that substances which are closely related chemically often form crystals of very similar shape and only slightly different interfacial angles; such crystals are called isomorphous. We now know, as a result of X-ray diffraction studies, that the absolute dimensions of the structural units (unit cells) and the precise arrangements of the atoms are indeed very closely similar in such crystals. The closely related substances which form isomorphous crystals are often capable of crystallizing together in "mixed crystals" or "solid solutions" containing two or more substances, and Hermann Franz Moritz Kopp observed in 1840 that the tendency to form mixed crystals goes with similarity of molecular volume. This observation again foreshadows modern knowledge that molecules capable of forming mixed crystals are similar in absolute shape and size.

A still more subtle aspect of the subject was revealed by Louis Pasteur, who in 1848 found that tartaric acid forms two types of crystals related to each other as an object to its mirror image or a left to a right hand, and that a solution of one type rotates the plane of polarized

light to the left while a solution of the other gives a corresponding rotation to the right. This discovery was interpreted as indicating that two types of molecules of tartaric acid, each the mirror image of the other, existed and that the mirror-image relation (enantiomorphism) of the molecules is carried over into the crystal structures, which are regular arrangements of the molecules. Equal numbers of the left- and right-handed molecules can also crystallize together to give a third type of crystal (a racemic acid crystal) of quite different structure. Many other examples of the same phenomenon have since been discovered, and the enantiomorphism of the molecules concerned is now well substantiated by precise determinations of their configurations.

To Haüy's original generalization and its later amplifications some other remarks must be added to complete the broad overall view of the subject. In the first place, some substances which are not enantiomorphic are polymorphic—that is, they are capable of forming two or more types of crystals, which are different spatial arrangements of identical molecules or ions. For some substances, the different polymorphic forms can exist for indefinite periods of time at the same temperature, as with calcite and aragonite, the two mineral forms of calcium carbonate. For others, such as ammonium nitrate, which can form five different crystal structures, each is stable only over a limited temperature range, and if the temperature is progressively changed, each structure changes spontaneously at a sharply defined transition point into the next. It should also be remembered that for all crystals except those belonging to the cubic system the precise shape of the unit cell of any one crystal structure changes slightly with change of temperature. For tetragonal, hexagonal and orthorhombic crystals the non-equivalent edge-lengths of the unit cell have different coefficients of expansion, while for rhombohedral, monoclinic and triclinic crystals the nonorthogonal angles may also vary with temperature.

The unit cells of all the crystals of the many different substances which crystallize in the cubic system are of course all exactly the same shape: they are perfect cubes. Differentiation thus cannot be made on the basis of unit cell shape alone. Some measure of classification could be made on the basis of face development, since some crystals of cubic symmetry crystallize as cubes, others as octahedra, rhombic dodecahedra, or other more complex forms; but inasmuch as face development is often influenced by crystal growth conditions this basis leaves something to be desired. Thus, on a purely morphological basis the thesis of specificity seems to break down in the case of the cubic system, since many substances of very different chemical constitution crystallize in structures of cubic symmetry. However, other crystal properties, such as density and refractive index, do vary greatly from one substance to another, and, moreover, the absolute size of the cubic unit cell (at a given temperature), which can be determined by X-ray diffraction methods, is highly specific to each substance; and so the assertion of a highly specific relation between chemical constitution and crystal characteristics in the wider sense is valid.

Crystal Structure in Relation to Atomic and Molecular Geometry and Interatomic Forces.—By the use of X-ray diffraction methods, which were introduced in 1912 by Max

Laue and Sir William Henry and Sir William Lawrence Bragg, the atomic arrangements in very many crystals have been discovered. A survey of the results throws a good deal of light on the factors which determine the crystal structures of many different chemical substances. First among the concepts which help to build up a satisfying general picture is that of an atom as a spherical object of definite radius, of the order of 10^{-8} cm. Many chemical elements form simple crystal structures which may be regarded as close packings of spherical atoms: we may imagine spherical atoms drawn together by forces of mutual attraction and thus settling down in arrangements which appear to be determined by the requirements of economical packing rather than by the operation of specific directed bonds between neighboring atoms. There are actually two simple close-packed arrangements of spheres with the same packing density, the face-centered cubic structure and the hexagonal close-packed structure (Fig. 1), and about half the chemical elements (the rare gases and many metals) crystallize in one or other of these forms. A few crystallize in both. Different atoms have different radii, so that the unit cell size is characteristic of the element. Other metals crystallize in the less closely packed body-centered cubic arrangement, or in hexagonal, rhombohedral, or tetragonal arrangements which are not close-packed

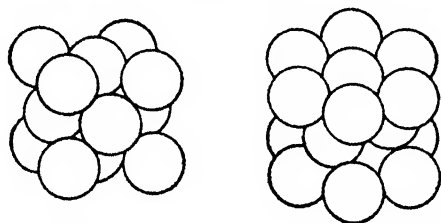


Fig. 1.—Crystal structures of many elements. *Left*: Cubic close packing. *Right*: Hexagonal close packing.

arrangements of spheres. The existence of such arrangements may be interpreted either in terms of atomic force fields which affect not only the nearest neighbors but also more distant atoms, or in terms of nonspherical atoms or directed bonds. A few elements of less pronounced metallic character, gallium and uranium being examples, have much more complex structures for which no simple explanations have been suggested, but which may be interpreted in terms of specific directed bonds between neighboring atoms. These elements and their crystal structures are intermediate between metallic and nonmetallic

ones. Nonmetallic elements in general have more complex crystal structures than the metals, owing to the formation of specific directed bonds between atoms. This feature leads, for elements of low valency, to crystal structures containing localized atomic groupings which we call discrete molecules, while elements of high valency form continuous networks of directed (homopolar) bonds, the details of which are determined by bond angles. A molecule of a low-valency element is a tightly bound group of atoms, usually persisting in the liquid and gaseous states as well as in the solid, which has an effective size like that of an assemblage of partly merged spheres. The crystal structure is a packing of these assemblages, in which the distances between neighboring atoms (held by strong primary

bonds) in the same molecule are much smaller than those between the nearest atoms in neighboring molecules. Thus the halogens form diatomic molecules, each having the shape of a pair of partly merged spheres, while sulphur forms eight-atom rings (Fig. 2). The packing together of such molecules results in structures which are usually more complex than those of the majority of metals, in that two or more differently oriented molecules comprise the unit of pattern; nevertheless the more highly symmetrical systems (cubic to orthorhombic) are favored, in con-

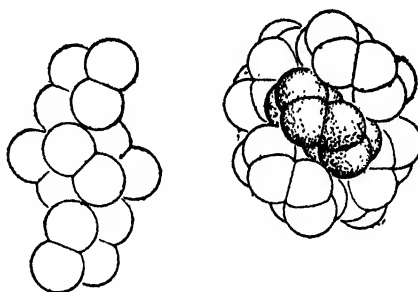


Fig. 2.—Crystal structures of two nonmetallic elements. *Left*: Iodine. Two-atom molecules. *Right*: Sulphur. The molecules are puckered eight-atom rings, seen edgewise; one molecule is shaded.

formity with the high symmetry of the molecular structures. The full symmetries of the molecules, however, are not necessarily carried over into the symmetries of the crystal structures, which appear to depend largely on the requirements of economical packing of the nonspherical molecular shapes, though localized or directional forces between the molecules may also play a minor part.

The high valency of carbon leads to the formation, in diamond and graphite, of continuous networks of specific, highly directional homo-

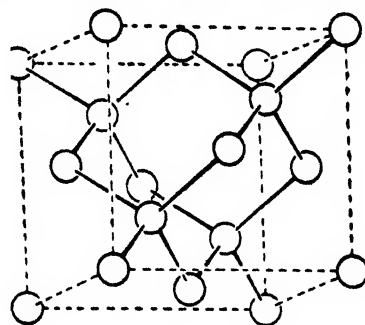


Fig. 3.—Structure of diamond. (Skeletal representation: the sizes of the spheres have no significance, but merely serve to mark atomic centers.)

polar bonds, characterized in diamond by a regular tetrahedral arrangement of the four bonds of each atom, giving rise to a special cubic structure (Fig. 3), and in graphite by six-atom rings linked in honeycomb fashion to form plane sheets, which are stacked to form crystals of hexagonal symmetry.

The crystal structures of compounds are determined, in the first place, by the type of forces holding the different atoms together: the crystal structure types conform to the chemical classification of compounds based on the distinction between metallic and nonmetallic elements and their positions in the periodic table. The extreme

types are, firstly, crystals of alloys and inter-metallic compounds, which are closely related to those of the metallic elements; secondly, the compounds of nonmetallic elements, which are either arrangements of discrete molecules or continuous networks linked by directed bonds, just as in the crystals of nonmetallic elements themselves; and thirdly, the ionic compounds of metallic with nonmetallic elements, in which electrical forces between oppositely charged atoms or groups of atoms play an important part. But in addition to the extreme types, there is a range of intermediate types, some of which are of considerable crystallographic complexity.

True metals—the alkali and alkaline earth metals, and the transition metals like iron, together with copper, silver, and gold—form extensive ranges of solid solutions, with crystal structures like those of the constituent elements, if the atomic radii do not differ by more than about 15 per cent. If the radii are very different, compounds of definite composition are formed in which the relative numbers of atoms and the crystal structures depend on the packing capabilities of the different-sized atoms. The crystal structures are usually of high symmetry, cubic or hexagonal.

Compounds of alkali and alkaline earth metals with the less metallic elements, those of the B sub-groups of the periodic table, tend toward the ionic type which is considered later. But alloys of the transition metals with the less metallic elements form crystal structures which are determined by principles peculiar to the metallic state. The positively charged metal atoms are embedded in, and held together by, a sea of wandering valency electrons, and the crystal structures of these substances are apparently determined, as William Hume-Rothery (1899–) discovered, solely by the relative numbers of atoms and valency electrons; the relative numbers of the different atoms and the particular atoms by which the electrons are contributed appear to be of little importance. The chemical formulae of such phases are sometimes rather complex—for example, Cu_3Sn and Cu_5Zn —but the crystal structures are usually of high symmetry. With combinations of two B sub-group elements we return to compounds of simple, definite composition; the crystal structures are continuous networks of directed bonds. Throughout the various classes of intermetallic compounds, the crystal symmetry tends to be high.

A crystal of an ionic compound is an arrangement, electrically neutral as a whole, of positively and negatively charged atoms or groups of atoms, the structure of which is determined, as Viktor Goldschmidt realized, about 1926, by the relative numbers of positive and negative ions, by the demands of local satisfaction of electrical forces (positive ions being surrounded by negative ions and vice versa), and by the relative sizes and shapes of the ions. In the chemically simple ionic crystals composed of monatomic ions the influence of relative ionic size is particularly clear; for instance, many crystals of compounds of type RX (with equal numbers of positive and negative ions) are cubic, but the actual arrangement depends on the ratio of the radii of the two ions (see Fig. 4). For very low ratios, between about 0.2 and 0.4, packing considerations lead to structures like that of zinc sulphide, in which each ion is surrounded by four of opposite charge; from about 0.4 to 0.8, the sodium chloride arrange-

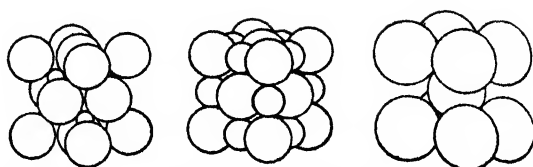


Fig. 4.—Structures of ionic crystals of type RX (containing equal numbers of monatomic ions). *Left:* Radius ratio 0.2–0.4 (zinc sulphide type). *Center:* Radius ratio 0.4–0.8 (sodium chloride type). *Right:* Radius ratio 0.8–1.0 (caesium chloride type).

ment is formed, in which each ion is surrounded by six of the opposite kind; and finally, from about 0.8 to 1.0, the caesium chloride structure in which the surround, or co-ordination, number is eight is formed. (The radius ratio limits quoted are not strictly observed: geometry is not the only factor, though it is the dominant one, for these substances.) Similar considerations determine many RX_2 structures, which again tend to be crystals of high symmetry.

In some ionic compounds, cadmium iodide being an example, the principle of local satisfaction of electrical forces is apparently abandoned, for the structure consists of composite layers, each consisting of a sandwich of a sheet of positive ions between two sheets of negative ions, within a layer each positive ion is surrounded by negative ions, but contacts between successive layers are contacts between sheets of negative ions. This phenomenon appears to be due to the strong polarization of the large negative ions—electrons are drawn in toward the positive metal ions in the center of the layer, leaving the outside of the layer less strongly charged, so that the forces between layers are more akin to those between discrete molecules. This type of crystal is thus intermediate between the ionic and molecular types.

In crystals containing polyatomic ions, in which atoms are held by directed bonds in precise configurations (for example, in carbonates and sulphates), packing considerations result in more complex and, on the whole, less symmetrical structures; orthorhombic and monoclinic crystals are more common than in any of the classes hitherto considered.

One of the most important classes of the more complex inorganic substances is the large group of silicate minerals, in which the binding is intermediate between the ionic and homopolar types. The subject of mineralogy has been largely rewritten as a result of the work of Sir W. L. Bragg and his school, who showed (1920–1930) that the basic motif of the silicate minerals is a group consisting of a silicon atom surrounded by four oxygen atoms. The linking of these groups in various ways to give silicon-oxygen networks held together by metallic ions results in a great variety of structures, which are often of considerable complexity and low symmetry (monoclinic or triclinic). Unlimited stringlike complexes give rise to minerals of the fibrous type like chrysotile, unlimited sheetlike complexes give micas and similar platy minerals with ready cleavage, while three-dimensional complexes form the structural basis of the feldspars and other rock-forming minerals.

Compounds of nonmetallic elements of low valency form discrete molecules, the packing of which depends partly on their shape but also on local electrical interactions, especially for those of strongly dipolar character. Compounds, like

silicon carbide, consisting of elements of high valency tend to form continuous networks linked by strong directed homopolar bonds, as in diamond.

The most important compounds of nonmetallic elements are the organic compounds, the combinations of carbon with elements of lower valency, chiefly hydrogen, nitrogen, and oxygen. These substances form discrete molecules, often of great complexity, which may be regarded as limited networks terminated by the atoms of lower valency. The crystal structures of hydrocarbons and others containing only weakly dipolar atomic groupings appear to be determined chiefly by the packing capabilities of the molecular shapes (see Fig. 5), but when strongly dipolar groups are present, such as hydroxyl, carboxyl, or amide groups, localized directional electrical attractions play an important part. The symmetries of crystals of organic compounds tend to be low—orthorhombic, monoclinic, or triclinic. Even highly symmetrical molecules very often do not form highly symmetrical crystals; for example, benzene, in spite of the full hexagonal symmetry of the molecules, forms orthorhombic

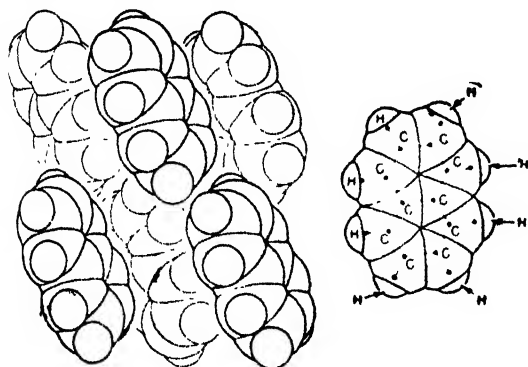


FIG. 5. —Structure of naphthalene crystals. A single molecule is shown on the right, with atomic centers and chemical bonds marked. In the crystal structure (left) the molecules are seen nearly edge-wise

crystals, and hexamethyl-benzene molecules, which are also hexagonal, form triclinic crystals. On the other hand, hexamethylene tetramine molecules, which have tetrahedral symmetry, form cubic crystals. The actual arrangement appears to depend on packing capabilities, which may or may not utilize the symmetries of the molecules themselves.

There is a rough reciprocal relation between molecular shape and crystal habit, for flat molecules tend to pile rapidly, giving needle crystals, while chain molecules pack in parallel fashion like sticks, giving rise to platy crystals. Very long chain molecules like the natural and synthetic polymers used for rubbers, plastics, and fibers do not usually form individual crystals containing whole molecules; they form aggregates in which only limited portions of the chain molecules form crystalline arrangements with their neighbors. But some of the very complex protein molecules coil up in a regular way to form compact molecules which are able to crystallize well. In electron microscope photographs by Ralph W. G. Wyckoff (1897–) of some of these crystals, the individual globular molecule can be clearly seen, arranged in just the manner already deduced from X-ray diffraction patterns of the crystals.

Applications of Crystallographic Methods to Chemical Problems.—Identification.—Crystallographic methods of identifying chemical substances are valuable for more than one reason: they are nondestructive, they require very small amounts of material, and, as compared with chemical methods, they identify, not merely atoms or functional groups of atoms in a compound, but the actual compound itself. Three different crystallographic methods are used. One is based on the measurement of interfacial angles, the second on measurements of refractive indices and other optical characteristics, and the third on the pattern of diffracted X-rays obtained when a monochromatic beam is passed through the specimen.

Attempts to use 19th century morphological methods for identification were not entirely successful, although much progress had been made. In the present century T. V. Barker (1881–1931) and his school have devised an effective systematic method based on a set of empirical rules for assigning indices to faces and the use of lists of key angles. The capabilities of the method are limited by the necessity of obtaining well-formed crystals large enough to be handled individually; and it is not valid for crystals of the cubic system. Nevertheless the Barker index of crystals offers a valuable method of identification.

For transparent crystals it is possible to measure under the microscope the principal refractive indices—up to 3 in number for the crystals of lowest symmetry—by methods based on immersion of the crystals in liquids of known refractive index. At the same time other optical characteristics may be observed. Identification is effected by reference to tables in which crystals are listed in order of the intermediate index of biaxial crystals (triclinic, monoclinic and orthorhombic), the index for the ordinary ray of uniaxial crystals (tetragonal, hexagonal, and rhombohedral), and the sole index of isotropic (cubic) crystals. Mineralogists have for long used related methods of identifying constituents in rock sections. The advantages of these methods are that they can be used for powders consisting of microscopic grains of quite irregular shape, and that they are applicable to mixtures of several constituents.

The most effective crystallographic method of identification is the X-ray diffraction method. The diffraction pattern of a crystal consists of a number of diffracted beams of different intensity, each at a definite angle; the pattern is of such complexity that it can be used as a fingerprint of the substance. The X-ray diffraction method is most frequently used for powders consisting of small, randomly oriented crystals, irradiated by a narrow beam of X-rays which need not be strictly monochromatic but must contain a strong component of sharply defined wave length. The pattern is recorded either on photographic film or on Geiger counter equipment. Identification is effected by reference to a card index published by the American Society for Testing Materials, in which the three strongest diffracted beams of each substance are arranged in order of the crystal plane spacings corresponding to their diffraction angles. This method, like the refractive index method, can be used for mixtures of several constituents, and has an even wider application, as it is suitable for crystals of all substances, even if they are of submicroscopic size. Approximate quantitative analyses of mixtures, including

mixtures of polymorphous forms of any one substance, and solid solutions can also be made by this method.

The X-ray powder method of identification is widely used for inorganic substances. Its application to organic substances, however, is less developed, owing to lack of data on the vast numbers of substances, and to the increased possibilities of similarity between powder diffraction patterns of closely related substances (such as large molecules differing only in the position of a single atom). Differentiation in such cases can be effected by single crystal X-ray diffraction patterns, which are sure to display some differences of unit cell dimensions and of relative intensities of the diffracted beams. In the use of this method of identification the work of John Desmond Bernal (1901–) and his school on the sterols is notable. The method is not direct and systematic, but rests on *ad hoc* comparisons with the patterns of known standard substances.

Determination of Molecular Weight.—The dimensions of the unit cell of a crystal may be measured accurately by X-ray diffraction methods. If the volume of the unit cell is multiplied by the measured density, the weight of the matter in the unit cell is obtained. Since the unit cell contains either one or some small number of molecules, the unit cell weight is equal either to the molecular weight or a small multiple of it. Consequently, if a rough idea of the molecular weight is known from other evidence, the precise value can be obtained from the X-ray data and the density. This method is particularly valuable in cases where the standard physicochemical methods fail.

Determination of Precise Stereochemical Details.—By detailed interpretation of X-ray diffraction patterns, it is usually possible, for crystals which are not too complex and molecules containing up to 20 or 30 atoms (excluding hydrogen atoms), to determine the precise positions of all the atoms in the unit cell, except perhaps hydrogens. This information gives the detailed stereochemistry, not only the general arrangement but also the precise interatomic distances and the angles between the bonds. The general conclusions on atomic sizes and arrangements have been mentioned earlier. It remains to point out that the conclusions have contributed much to the development of the theory of chemical bonding and the relations between interatomic distances and the type of bonding, the number of bonds formed by any one atom, and the angles between the bonds. In organic chemistry, the tetrahedral disposition of the four bonds of saturated carbon compounds suggested by Joseph Achille Le Bel and Jacobus Hendricus Van't Hoff in 1874 has been quantitatively confirmed, and with it the basis of the enantiomorphism of the tartaric acids and similar substances. Further than this, it has even been found possible to discover which of the two mirror-image configurations of molecules is found in each type of crystal; this historic completion of the edifice of stereochemistry begun by Pasteur was achieved in 1950 by Johannes Martin Bijvoet (1892–) working appropriately in the Van't Hoff laboratory in Utrecht. Among other complex problems of stereochemistry solved by X-ray crystallography, we may mention that the configurations of sucrose and other sugars and those of isomers of some of the cyclohexane derivatives have been discovered. The planar configurations of double-bonded groups and the

linear character of triple-bonded groups have also been established, together with the relation between bond length and bond order. Aromatic ring systems are found to be planar, and the precise lengths of the bonds in the various different situations in multi-ring systems are found by John Monteath Robertson (1900–) and his school to be in general agreement with the results of calculations based on the wave-mechanical theory of electronic bonding.

A great deal of information in intermolecular stereochemistry has also been accumulated as a result of measurements of distances between atoms in neighboring molecules. The effective external radii (Van der Waals radii) of different atoms in a variety of situations, and the relations between interatomic distances and the type of attractive forces, are now known. For example, it is now known that hydrogen bonding between acid, alcohol, and amide groups in neighboring molecules results in shortened interatomic distances.

Although for crystals of complex organic substances it is usually necessary to know the chemical constitution in order to solve the intricate puzzle of the crystal structure, it has sometimes been possible, notably in the case of the penicillin salts, to decide between alternative suggested chemical formulae by detailed crystal structure determination. Finally, the methods of X-ray crystallography are being applied to what is probably the greatest problem of chemical constitution and stereochemistry, that of the structure of the proteins. See CRYSTALLOGRAPHY—*Crystal Structure*.

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C. W. BUNN,
Imperial Chemical Industries, Ltd., Plastics Division,
Welwyn Garden City, England.

CHEMICAL ENGINEERING. **Definition.**—With the widening of the work of the chemical engineer, attempts have been made to define chemical engineering in the broadest and most fundamental manner. For instance, chemical engineering has been defined as that branch of engineering having to do with chemical change on the manufacturing scale or with physical changes connected therewith. However, the following older and classical definition is certainly more explanatory: "Chemical engineering is that branch of engineering concerned with the development and application of manufacturing processes in which chemical or certain physical changes of materials are involved. These processes may usually be resolved into a coordinated series of unit physical operations and unit chemical processes. The work of the chemical engineer is concerned primarily with the design, construction, and operation of equipment and plants in which these unit operations and processes are applied. Chemistry, physics, and mathematics are the underlying sciences of chemical

engineering, and economics its guide in practice."¹

Origin.—In London in 1880 an attempt was made to found a society of chemical engineers. However, because of the small number interested, this society did not materialize. George L. Davis gave a series of lectures in 1887 in Manchester, England, which were expanded into his book *Handbook of Chemical Engineering*. While this presentation was largely qualitative, it did embody, in a formal presentation, the beginnings of our modern chemical engineering. Davis in this early work laid stress upon the importance to a practicing chemical engineer of a broad knowledge of chemistry, physics, and mechanics. He pointed out the necessity of acquaintance with materials of construction and corrosion, emphasizing the latter as one of the distinctive characteristics of the practice of chemical engineering.

Chemical engineering has grown out of chemistry and certain aspects of mechanical and metallurgical engineering during recent decades somewhat similarly to the way electrical engineering grew out of physics several generations ago. The rapid development of the chemical industry before, during and immediately following World War I brought so many new facts to the attention of the technical men engaged in this line of manufacture that the branch of engineering recognized now as chemical engineering came into a lusty growth. This took place rapidly in America and arose as a result of scientifically classifying the unitary aspects of many diverse and unlike procedures. Out of this classification arose as the first foundation of chemical engineering, the concept of the unit operations. This led to the intensive study of individual unit operations, such as filtration, centrifugation and many other of these physical aspects of the chemical industry. Much of the credit for the unit operations viewpoint should go to a group of chemical engineers associated with the Massachusetts Institute of Technology and led by William H. Walker and Arthur D. Little. Walker joined the faculty of the Massachusetts Institute of Technology in 1903 for the purpose of reconstructing the chemical engineering curriculum. It had been started in 1887. His work can best be described in the words of Warren K. Lewis:

"Walker inaugurated the instruction in the fundamental processes of chemical industry in these early years. (I² remember helping him in the development of his analysis of distillation in the fall of 1905 when I was an assistant in the laboratory under him.) The credit for recognizing the type of training needed by the men who were to solve the problems of chemical industry is clearly his. However, Walker and Little had worked together for many years and it was Little who, recognizing the character of the innovations of Walker, coined the phrase 'Unit Operations' (about 1914). Furthermore, to Little belongs the full credit for the suggestion of the School of Chemical Engineering Practice as an effective method for giving the student practical training in engineering work."

This unit operations method of handling the physical aspects of chemical engineering was

embodied in formal shape by three professors of this same institute namely, William H. Walker, Warren K. Lewis, and William H. McAdams in their book *Principles of Chemical Engineering*, published in 1923.

Later on, around 1930, the unit process concept, or the study of the unitary chemical aspects, came into the chemical engineering picture. This is still in its developmental stage and is being actively studied and defined.

Sphere.—The practice of chemical engineering lies in industrial application of chemical change or in the processing of chemicals. Particularly in the United States this has been so broadened and so extended that the industries wherein chemical engineering is practiced are often now called the "chemical process industries." The work in these industries includes the design, installation and supervision of plants for the manufacture of such products as acids, alkalis, salts, fuel gases, industrial gases, ceramics, cement, glass, fertilizers, sugars, starches, paper, rayons, solvents, explosives, war gases, paints, lacquers, leather, oils, soap, rubber, resins, plastics, intermediates, dyes, petroleum products and many miscellaneous chemicals and certain metals, such as aluminum, sodium, magnesium, calcium, tungsten and tantalum. These latter are shared with metallurgical engineering.

Divisions.—The two main divisions of chemical engineering are unit operations or physical changes and unit processes or chemical changes. The breaking down of chemical engineering into these more or less common units has been extraordinarily simplifying and has enabled much order and advancement to be applied to this rapidly growing branch of engineering. However, chemical engineering cannot be defined simply as a summation of the units of these two divisions. Judgment, experience, vision, humanity, and the ability to work with other men are as necessary for success in chemical engineering as in any other human endeavor.

The cutting across the diverse industries involving chemicals and chemical change by the unifying principles of the unit physical operations and the unit chemical processes emphasizes the similar aspects. This acted as a stimulus to further research towards a formulation of the general laws pertaining to unit operations and to unit processes. This quantitative formulation is still progressing but it is the very basis of chemical engineering.

The study and observation of the principles involved in the operations of evaporation, crystallization and filtration, for example, throughout the sugar industry, not only increased the usefulness of these unit operations in this sugar industry and others already using them, but enabled these same principles to be more intelligently and usefully applied to newer and developing industries. This is engineering progress.

Physical Changes or Unit Operations.—Unit operations are the older of the two main divisions of the units into which we customarily break down chemical engineering. More emphasis has been placed upon the study of these physical changes than the other or chemical changes largely because of the fact that the study of these unit operations had never been undertaken by the chemists in any serious way. On the other hand, the investigation and formulation of unit operations have long been the distinguishing characteristic of much of the research

¹ Newman, quoting Kirkpatrick, *Development of Chemical Engineering Education*, Supplement to *Transactions American Institute Chemical Engineers*, 34, No. 3a, p. 6, 25 July 1938; see also *ibid.*, 32, 568 (1936).

² Warren K. Lewis.

in chemical engineering. The chemical engineers interested in this phase have been very successful in the establishment of hypotheses and later on of laws pertaining to unit operations. The most recent book in this field is that written by Prof. G. G. Brown, *et al.* entitled simply *Unit Operations* (see *Bibliography*). Here Professor Brown has classified the various unit operations under four main headings of: (1) solids; (2) fluids; (3) separation by mass transfer; and (4) energy and mass transfer rates. In this book by Dr. Brown and in many of the other publications pertaining to unit operations, there are available formulations expressing the laws pertaining to these various physical changes. However, the best over-all summary of unit operations together with detailed literature references can be had from *Chemical Engineers' Handbook* edited by J. H. Perry (see *Bibliography*).

There are many ways to name the unit operations and to classify them. In the following table is listed the principal unit operation, arranged under the subheadings of energy transfer and mass transfer. However, some of the unit operations involve both energy transfer and mass transfer. In arranging this table the unit operation was placed under whichever one of these subheadings seemed to be the more important. In the table of the principal unit operations, an attempt has also been made to point out that many of these can be considered the reverse of another unit operation. This has been done by writing, for instance "heating vs. cooling."

PRINCIPAL UNIT OPERATIONS

Energy Transfer

(A) Mechanical energy transfer

1. Size reduction (crushing and grinding) vs. size enlargement

(B) Heat energy transfer

3. Heating vs. cooling
4. Evaporation vs. evaporative cooling

Mass Transfer

(A) Bulk mass transfer

5. Transportation of fluids (fluid flow)
6. Material handling (transportation or storage)
7. Classification or sedimentation of solids vs. fluidization
8. Flotation
9. Filtration (fluid flow through porous media)
10. Centrifugation
11. Mixing vs. separation (sedimentation)

(B) Molecular mass transfer

12. Distillation vs. absorption (liquid-liquid)
13. Extraction or leaching vs. crystallization
14. Adsorption
15. Gas diffusion
16. Drying

It has appeared to the writer and his associate, Prof. T. C. Doody of Purdue University, that the above classification is the simplest and best one available and is very superior to the classical method of simply naming: flow of fluids, filtration, heat transmission, evaporation, distillation, adsorption, absorption, extraction, crystallization, humidification, drying, size change, mechanical mixing, separation and transportation. As investigation proceeded, newer unit operations were added to this classical list as new physical aspects developed and were studied, for example, such as gas diffusion.

Chemical Changes or Unit Processes.—

Unit processes pertain to the various groups of chemical changes such as are carried on in our factories in a competitive and economical manner. This definition gives to unit processes a manifold aspect and includes: (1) the basic chemistry of the reaction; (2) the equipment in

which the reaction takes place; and (3) the conductance of the entire process with a sufficiently low cost as to be competitive. The following table gives examples of these unit processes:

PRINCIPAL UNIT PROCESSES

- | | |
|--|---|
| 1. Combustion | 17. Hydrogenation, dehydrogenation and hydrogenolysis |
| 2. Oxidation | 18. Alkylation |
| 3. Neutralization | 19. Friedel-Crafts |
| 4. Silicate formation | 20. Condensation |
| 5. Causticization | 21. Polymerization |
| 6. Electrolysis | 22. Diazotization and coupling |
| 7. Double decomposition | 23. Fermentation |
| 8. Calcination | 24. Pyrolysis or cracking |
| 9. Dehydration | 25. Aromatization |
| 10. Nitration | 26. Isomerization |
| 11. Esterification | 27. Acylation |
| 12. Reduction | 28. Hydroformylation (oxo) |
| 13. Ammonolysis | 29. Ion exchange |
| 14. Halogenation | |
| 15. Sulfonation | |
| 16. Hydrolysis and hydration (saponification, alkali fusion) | |

In applying these chemical changes industrially, the chemical engineer is particularly concerned with: (1) how far the chemical change will go or the chemical equilibrium; this is the basis of the chemical conversion and yield; (2) how fast the chemical change takes place or chemical kinetics; (3) the equipment for the chemical change; and (4) the cost of the process.

Chemical conversion refers to the per cent, generally expressed molecularly, of the main raw material converted into the principal finished product. Frequently these chemical reactions do not convert all of the initial raw materials into the products, some raw materials being recovered and used over again. Hence, there is a net consumption of the raw material or materials. The percentage of the net raw material converted into the product is the yield of the reaction.

The ethics of the chemical engineer should always lead him to render the best service to his organization and to society. This is reflected in the production of low cost goods so that more people can consume them. In order to do this, conversion and yields must be high. Therefore, for the most economic performance of a given industry, reactions and conditions must be chosen which aim at the obtaining of both high conversion and high yields. Thus wastes are avoided both in material, energy and labor.

A summary of the advantages of the unit process classification as applied to the chemical industry may be summarized as follows¹:

(1) The *unitary* or like aspects are accentuated by subdividing the various processes into their individual unit process characterized by the *basic chemical reaction*. Such things as similarity in energy change, corrosion, reaction time, catalysis, pressure, equilibrium and raw materials are emphasized.

(2) To an increasing extent, one finds in different chemical plants a *factory segregation* according to the unit process. A building or a part of the plant will be set apart to carry on nitration or hydrogenation, alkylation or pyrolysis or fermentation.

(3) The close relationship occasioned by factory segregation brings together like *equipment*. In the area of the plant devoted to hydrogenation, there will be much similarity in the equipment used for this unit process. This likewise will prevail for reductions or nitrations or many other of the unit processes.

(4) The segregation and the similarity in equipment lead more easily to the *multiple use* of equipment. Of course, the aim of the plant manager is to employ a given piece of equipment year in and year out for the making of the same chemical but frequently markets vary, and for this one piece of equipment can be used at one time for the halogenation of one chemical and later on for that of another. Indeed, in the advertisements of chemical

¹ Compare Shreve, R. Norris, *Chemical Process Industries*, Chap. 2 (see *Bibliography*).

journals, one sees chemical concerns advertising custom hydrogenations, for example.

(5) Above anything else, the classification and arrangement under the unit process concept enable the chemical engineer to design and plan on the basis of group performance. In this way basic principles pertaining to an entirely similar group of reactions are emphasized rather than the specific details of individual performance. These specific details enter more into a modification of the group conditions. Past knowledge with other members of a group help greatly in the handling of the manufacture of a new chemical within this same group.

(6) However, the outstanding characteristic of the unit process classification is that the emphasis in the chemical process industries is on the *chemical change*, that is, on the chemical reaction. In the large majority of manufacturing procedures in the chemical field, this is necessary because by the increase in the yields of even only a few per cent, there results usually a proportionally larger lowering of the cost than from other savings. This is because the cost of raw materials varies from 50 to 87 per cent of the manufacturing expense in the making of chemicals. Of course, similarly with such chemical savings should go the careful investigation of every unit operation involved in order to save heat or power or any other of the physical factors.

(7) There is no necessity to separate a unit process into *organic and inorganic phases* or even into the aliphatic and aromatic organic aspects. Indeed, it is more unifying not to make any such subdivision, since similar principles are connected with a unit process. This may be exemplified by the oxidation of carbon, hydrogen and naphthalene where the reaction of all are highly exothermic and the evolution of this heat must be carefully handled.

(8) With increasingly competitive conditions, the design of equipment for the arrangement of the various steps is given more and more emphasis by the chemical engineers. The unit process arrangement bringing together the analogous aspects of these factors, such as chemical reactions and equipment, enables the design chemical engineer to take advantage in a wide range of the manufacturing procedures, of any significant improvement in an individual reaction.

Catalysis.—A reaction may proceed to a very high yield at equilibrium but it may also take so much time to do this that the reaction would be a costly one in practice. This was true of the fixation of nitrogen from the air by reacting with hydrogen to form ammonia or of reduction of carbon monoxide with hydrogen to make methanol, until methods for increasing the speed of the reactions by the use of catalysts were discovered. Indeed, a very important aspect of the work of the chemical engineer is the development, design and operation of equipment for speeding up reactions through the application of catalysis.

Chemical Equilibrium and Chemical Kinetics.—These are both physico-chemical considerations. In many cases, the data are available so that for given reaction conditions the equilibrium and the speed can be expressed quantitatively and mathematically. This is a tremendous help to the chemical engineer in his endeavor to design plants for the manufacture of chemicals or to control chemical reactions under the most economical conditions.

Material Balances.—As materials are often the principal items of cost in chemical manufacturing, one of the chief functions of a chemical engineer in connection with these manufacturing processes, is to make a quantitative listing of all incoming raw materials and to balance these with all products and byproducts. This immediately discloses to him where wastes are occurring and acts as a stimulus to the more economic development of the procedure or of the industry being studied. Losses disclosed by such material balances may be both chemical and mechanical. To avoid chemical losses, it may be necessary to go back to the chemist in the laboratory for a further study of the fundamental chemical reactions concerned. To overcome mechanical losses there may be required a more careful design and a stricter application of the principles underlying

such unit operations as materials handling. Fig. 2 includes the very rough material requirements per ton of soda ash produced but it does not include a complete balance with nitrogen and calcium chloride wasted which should be included in any overall material balance.

Energy Balances.—In our chemical manufacturing operations energy may be consumed not only by the unit physical operations but also by the unit chemical processes. On the other hand, energy is evolved in the exothermic chemical reactions and frequently can be saved and used in the overall set-up. To secure an accurate calculation of all the energy changes concerned with a given industrial procedure, the chemical engineer works up a balance sheet listing quantitatively with their sources all the different types of energy required together with all the various kinds of energy concerned. While generally the overall picture requires that energy be supplied in the form of either fuel or electricity, there are cases where a factory has a surplus of energy generally from heats of reaction, and can dispose of it either in the form of power or of heat.

Flow Sheets.—In considering a given manufacturing process from the viewpoint of the original design or its operational control, it is fundamental in chemical engineering to break down the manufacturing steps to which the raw materials are subjected to furnish the salable product, into a coordinated sequence of these unit chemical processes and unit physical operations. This sequence is customarily illustrated in what are called flow sheets or flow charts. These are of varying complexity.

In Fig. 1 is depicted simplified or block type flow sheet such as is frequently employed by chemical engineers when they start taking a process from the research chemist in the laboratory through the pilot plant preparatory to the manufacturing establishment. As the details of the manufacturing procedure are worked out during the development, such flow sheets are elaborated and indeed frequently are changed into the diagrammatical flow chart as shown in Fig. 2. Here a diagram that simulates the different pieces of equipment is actually inserted in the sequence. In these various items of equipment, are carried out the unit chemical processes or unit physical operations as illustrated in the flow charts. In a pump, for example, the unit operation of *fluid flow* is industrialized. In the lime kiln of Fig. 2, the unit process of *calcination* is applied to the manufacturing sequence but this is also true of the unit operation of *heat transfer*.

At a later stage, the design chemical engineer may draw to scale each piece of equipment and cut these out of cardboard. Such cardboard replicas may then be juggled around to secure the best arrangements in the space of the building or of the plot chosen for the particular process. Quite frequently, many flow sheets will be worked out during the development of a process from the test tube to the actual manufacturing plant.

Pilot Plants.—The ideal, from an engineering viewpoint, would be to have available such data and formulas that a new establishment could be designed without a pilot plant. This may be true for a new factory for making a well known old product, but when a chemical engineer is engaged in the design and building of a chemical plant for an entirely new chemical or an entirely new process, the only safe procedure is to operate a

pilot plant as a most important steppingstone between the work of the chemist in the laboratory and the large manufacturing installation. The chemist in the laboratory can certainly secure quantitative conditions necessary for the obtaining of a good chemical yield but only in the pilot plant can the engineering aspects of the application of chemistry to industry be tested out effectively. The pilot plant frequently will be first an enlarged laboratory and then a small replica of the factory. Indeed, in certain large manufacturing operations, experience has shown that as many as five pilot plants should be successively constructed of increasing size. However, unless there are many radical aspects in a new process, one such pilot plant usually suffices.

The pilot plant should be built out of units comprising a small sized replica of what the design chemical engineer judges the large plant should be like. This pilot plant enables him to test out his judgment and to correct it if necessary. It also enables the chemical engineer to ascertain if he has chosen the right equipment to carry out the various unit physical operations and unit chemical processes the sequence of which represents the entire manufacturing procedure. Indeed, the pilot plant should be built in conjunction with the drawing of the later flow sheets and should represent the actual equipment which the flow sheet pictures on paper. In these pilot plants the same raw materials should be employed as are planned for the large manufacture, with equipment of the same composition so that corrosion can also be investigated effectively on the small scale and corrected prior to the construction of any large plant.

Equipment.—The chemical engineer deals with factory equipment. Much of his success will come from the proper selection and arrangement of this equipment in which the coordinated sequences of unit physical operations and unit chemical processes are commercialized. While much specialized equipment must be designed and tested in the pilot plant for chemical manufacturing, in most cases standard equipment is available in the shape of pipes, valves, pumps, filter presses, centrifuges, nitrators, sulfonators, and the like. This equipment is currently presented in the annual *Process Industries Catalog* and the *Chemical Engineers' Handbook* (see *Bibliography*.)

Process Instrumentation.—The chemical process industries are operated to an increasing extent every year on continuous procedures. Here the use not only of recording instruments but of *directional* instruments is a necessity to keep the procedure at the designed conditions. Such instruments are also a necessity for modern batch manufacture. These instruments save labor and produce more uniform products.

Economics.—As chemical engineers aim only to be concerned with procedures which are economically competitive, they must study the costs of the raw materials, the labor situations and the markets for the goods. Here the governmental statistics pertaining to the production of raw materials and consumption of products are often of fundamental guidance. A successful chemical engineer must also be a good business man.

Plant Location.—The plant should be located in that position where it will give the best service to the public and hence, as a corollary, where it should make the most profit for its owners.

However, plant location is not as simple as this because other factors enter therein such as adequate water, fuel, power, climate, labor supply and lack of legal restrictions. Likewise, in order to lower the general overhead of management, storage, distribution and sales, a new plant may be added to an already existing factory.

Work of the Chemical Engineer.—A chemical engineer is one who practices chemical engineering as already defined and elaborated. However, the chemical engineer is actually concerned with a wide variety of activities. These may be divided into the following main headings:

Research Development Design	Manufacture Sales Management	Teaching Consulting
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The chemical engineer who goes into sales or management may not be practicing the strict fundamentals of his engineering, but this training is often the best foundation for these other aspects of chemical industry. In sales, not only goods but services are involved; also in sales are the principal contacts with the markets from which arise demands for new products. Thus chemical sales need men with chemical engineering training. In the management of chemical plants, the chemical engineer has frequently come up through the very factory involved and consequently understands it thoroughly. He must, of course, possess those other qualities of personality, education and understanding that will enable him to direct other men and their work. This all means that the chemical engineer should be broadly *educated* in social values, business procedures and personal ideals rather than merely *trained* in the tools of his profession.

The Chemical Engineer and Society.—Like all engineers, the chemical engineer is accustomed by training and practice impartially to evaluate facts. He is also in the habit of collecting together these facts and of recognizing when sufficient data are not available to draw a sound conclusion. An engineer is competent to set in motion those lines of investigation needed when the facts are required to place a sure foundation under any contemplated plan for action. In other words, an engineer acts upon demonstrated data, or he proceeds to acquire what is needed before acting.

In addition to dealing with these material aspects of this profession, he must work with men. He frequently must study a present situation and use his best judgment regarding what the future will bring forth. While these human and social values are harder to weigh justly and impersonally, yet the engineer should draw sounder conclusions on the average than one without this education.

All this lays the foundation for broader service than is embraced by the mere practice of his profession, important though this may be in supplying to society at large the technical products of the chemical industry. The managerial aspects of our companies, particularly of the larger ones, require that the incumbents possess the ability skillfully to evaluate equipment and men, as well as the service these men and equipment can render to society at large. Therefore, chemical engineering should be the group from which managers of our chemical plants are selected.

This same impartial evaluation of situations should also make engineering trained men important in the wider aspects of public service. All engineers should be encouraged to take a great

interest, and indeed to become active participants, in the affairs of their communities and of society at large. Perhaps, out of this will come, in time, social betterment plans based upon carefully collected facts and not upon the whims of pressure groups.

Registration of Chemical Engineers.—Practically all states require that chemical engineers, as well as other engineers who are in responsible charge of engineering work, be registered as professional engineers. The purpose of this registration is to protect the public welfare in the safeguarding of life, health and property by establishing, as defined by the registration laws of the various states, the minimum qualifications for persons engaged in engineering practice. This registration also protects the trained and experienced engineer from competition with inadequately educated men.

Professional Affiliations.—The American Institute of Chemical Engineers, founded in 1908, is the leading organization of chemical engineers. Its objects are to enhance the professional standing of members, and to enable them to render better service to themselves, their industry and the nation. There are four classes of membership: student, junior, associate, and active. Before advancement to active membership a member must have been in responsible charge of chemical engineering work for a varying period depending on his formal education (three years for a man with a Bachelor of Science degree in chemical engineering, and five years for one without formal training). The institute sets a high standard of ideals for the profession by virtue of its code of ethics. At semiannual meetings papers covering various phases of chemical engineering may be published monthly in *Chemical Engineering Progress*, together with other papers submitted directly. The institute also exerts a stimulating effect on instruction by accrediting only those schools of chemical engineering possessing adequate staffs and equipment. The office of the institute is in New York.

The American Chemical Society (q.v.) serves both chemists and chemical engineers. It publishes an outstanding list of useful journals containing papers both on chemical engineering and on the chemistry upon which chemical engineering is based. The principal periodicals are as follows: *Chemical Abstracts* (this contains abstracts of articles throughout the world both in pure chemistry and chemical engineering); *Industrial and Engineering Chemistry* (this is the outstanding periodical for publication of original research articles of permanent value in the field of chemical engineering); *Chemical and Engineering News* (this weekly magazine covers this technical field in its many phases). The society also publishes other magazines pertaining largely to the purely chemical aspects, namely, *Journal of the American Chemical Society*, and *Analytical Chemistry*.

The Engineers' Council for Professional Development is the functional agency of the major engineering societies of the country with its main object the enhancement of the engineer's services in the public interest.

Universities.—The schools of chemical engineering in the various universities and institutes of technology in the United States have taken a foremost position in the development of modern chemical engineering. The engineering divisions of chemical companies are likewise contributing

extremely important data upon which the future development of chemical engineering very largely depends.

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R. NORRIS SHREVE,
Professor of Chemical Engineering, Purdue University.

CHEMICAL EXTINGUISHERS. The five most common types of first aid extinguishers contain (1) foam; (2) soda acid; (3) vapor liquid; (4) carbon dioxide; (5) dry powder. Chemical extinguishers are brought into action by being inverted, or pumped, or by being both inverted and pumped.

Foam extinguishers contain a solution of aluminum sulphate and bicarbonate of soda with a foam agent; while soda acid extinguishers are charged with a bicarbonate of soda solution and sulphuric acid. Both of these types require protection from freezing, and neither is used on fires in live electrical equipment. Nor is the soda acid extinguisher used on burning oil, gears, or paints.

The vapor liquid extinguisher contains carbon tetrachloride and other components. The carbon dioxide extinguisher, as its name implies, is charged with carbon dioxide; and the dry powder extinguisher uses bicarbonate of soda and other powders. All of these three types do not require protection from freezing.

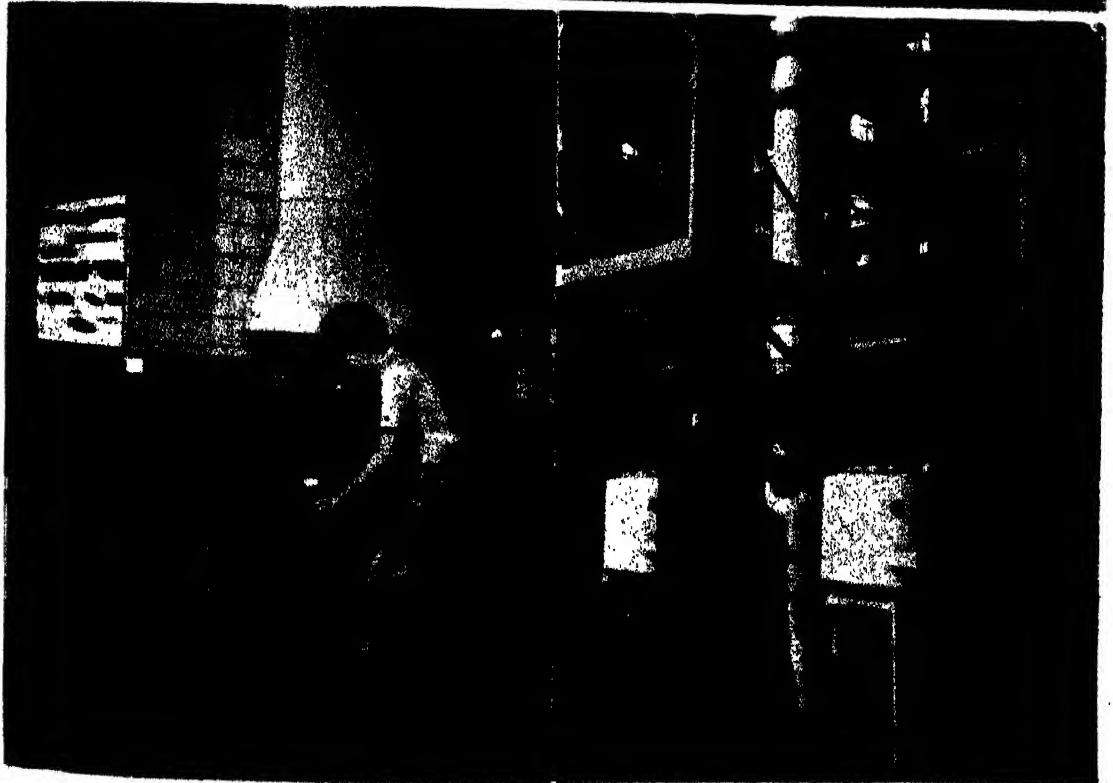
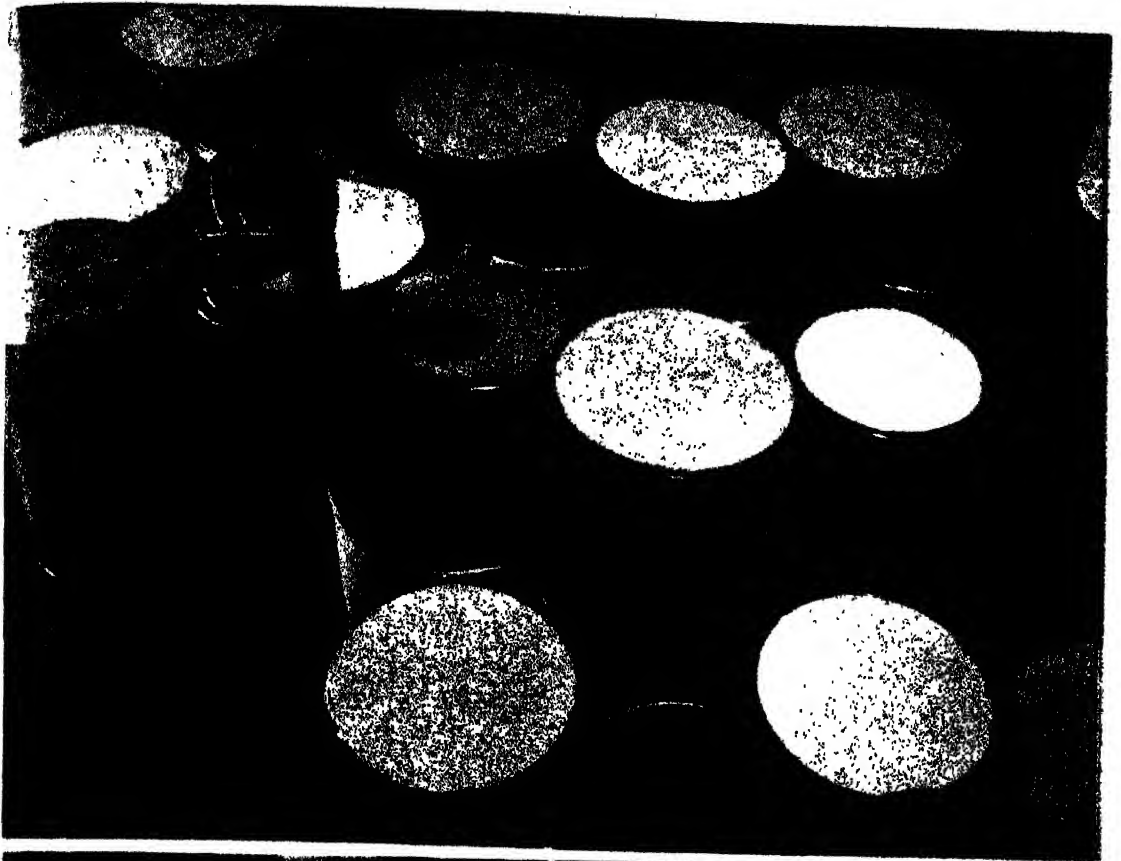
CHEMICAL INDUSTRIES. Chemistry has such an intimate and important part in modern industry that it is very difficult to define a chemical industry. The best test is whether or not the finished product is made of the same substances as the original raw material. A glass bottle is composed of wholly different chemical compounds from the sand, soda, and other ingredients which came into the factory, whereas an office desk is made of the same wood which went into the sawmill, and the glue which unites its parts and the varnish which coats it were not changed in the furniture factory.

For census purposes all manufacturing industries fall into seven broad classifications, one of which is called *Chemical Process Industries*. Since 1939 the value of the chemical process industries' products has increased fourfold.

The metals industries involve sufficient chemical changes from the raw ore to the finished alloy so as to be discussed briefly as chemical industries, even though the census classifies them separately.

Thus this article will discuss those industries in which the science of chemistry is sufficiently used to justify their inclusion.

CHEMICAL INDUSTRIES



Courtesy Monsanto Chemical Company

Top: Rainbow hues in Lustrax styrene molding powders at the Monsanto Chemical Company's Plastic Division Plant.
Left: Worker using the spectrograph, which determines the composition of any given sample, component elements, and their amounts. Right: One of Monsanto's pilot plants.



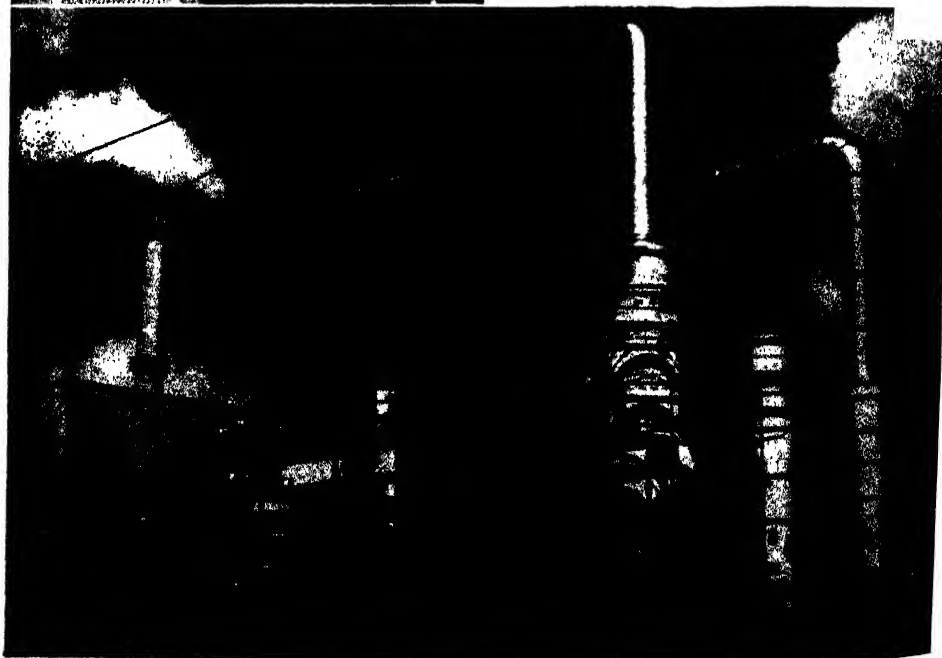
CHEMICAL INDUSTRIES

Above: Part of the Du Pont Sabine River Works, Orange, Texas, where natural gas is converted into hydrogen and carbon monoxide for the synthesis of methanol.

Left: Re-enactment of birth of the first completely synthetic fiber in the Du Pont research laboratories.

Below: Butadiene is transformed into a chemical used in the manufacture of nylon at Du Pont's Victoria, Texas, plant.

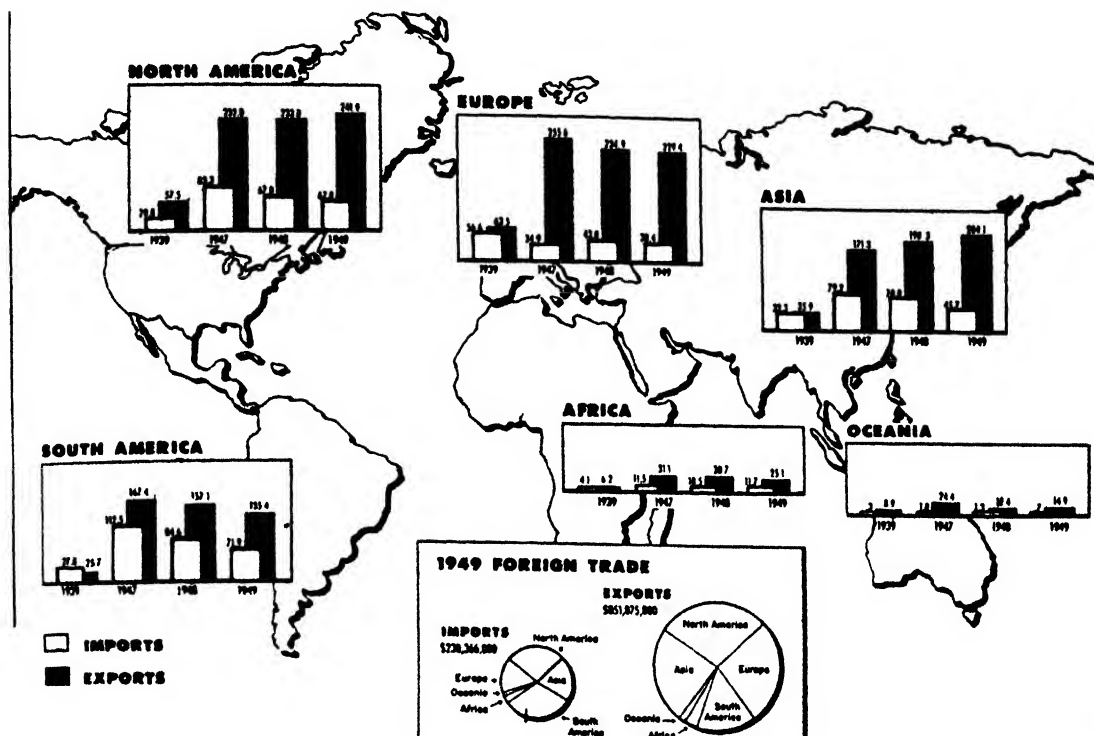
Photos Courtesy Du Pont Photo Library



There is a widespread notion that the chemical industries of the United States really began in 1914, when war stopped importation of European supplies. This is entirely wrong. John Winthrop (1606-1676; q.v.) was manufacturing chemicals in Connecticut before 1640. By the mid-19th century the chemical industries of the United States began to grow and by 1914 had

are fairly low. Relatively large amounts of steam and electrical power are needed. Wage scales are high, but the cost of labor is low in comparison with the value of products. Nearly four fifths of all chemicals are consumed in the chemical process industries themselves, most of them finding their way into such goods as rubber, paper, plastics, leather, and motor fuels.

CHEMICAL INDUSTRIES



Courtesy of Industrial and Engineering Chemistry, publication of the American Chemical Society.
 United States imports and exports of chemical and allied products, by regions of the world.
 Figures in millions of dollars. Source: United States Department of Commerce.

attained considerable size and importance. They were confined largely to heavy chemicals and to those industries which are more or less common to all countries. Potash was a German monopoly. Synthetic ammonia was then a relatively small European industry. Synthetic dyes and synthetic drugs required an enormous amount of research for which the United States was not then prepared.

Chemical industries are characterized by great economic flexibility. Several different raw materials are often available for the same product. Conditions alter yields of the major product and determine the number and character of byproducts. For example, the demands for aviation fuels were so great during World War II that such industrial fuels as refinery gases and high-boiling distillates were made into gasoline. Since 1945 the highly unstable condition of the coal industry has led to a large increase in the production of fuel oil.

Chemical industries depend for their profitable operation on continuous and large-scale production. High hazards in manufacture and transportation require expensive precautions, but the numbers of serious accidents and property losses

Research particularly characterizes the chemical process industries, causing rapid changes and making many products and processes obsolete. The cost of preliminary research and development may well equal the cost of erecting the final manufacturing plant. The most striking results of research are the great increases in production and in quality of products with corresponding lowering of costs. In 1910 an automobile tire cost \$50 and might last 5,000 miles. The same type of tire now costs one third as much, has four times the mileage, and is made in many times the quantity.

The members of the chemical profession may be broadly divided into two classes: chemists and chemical engineers. The chemist is primarily concerned with laboratory work of some sort, while the chemical engineer designs and operates the mechanical equipment in which a product is made. Chemical training is required for all the important functions of a chemical industry, including research, production, technical service, public relations, patents, and sales. Two thirds of the 70,000 chemists in the United States are in some type of industry, mainly in the chemical process industries, and more than three fourths

of the 25,000 chemical engineers are similarly employed. Both are relatively young professions, the median age of chemists being about 33 and that of chemical engineers slightly under 30. Research, development, production, operation, maintenance, analysis and testing, process control, management, and administration account for most members of the chemical profession in industry. Not more than 10 per cent are engaged in teaching.

A process begins with fundamental research on physical properties, reactions, methods of analysis, materials of construction, raw materials, and uses. If successful in the laboratory, the process must be tested with larger quantities. Finally a plant is designed and the product is made in large quantities in continuous operations. Chemists, chemical engineers, mechanical engineers, and technical salesmen all have a share in bringing a process to successful operation.

To the chemist any chemical manufacturing operation must be divided into a series of unit chemical processes, or types of chemical reactions common to each process. Oxidation is a unit process employed in making both sulphuric acid from sulphur and nitric acid from ammonia. The same unit process may result in a dye intermediate, a pharmaceutical, or a vulcanization accelerator, depending on the substances used. This concept of unit processes greatly simplifies chemical industries.

The first consideration in equipment is materials of construction. The larger part of all chemical operations employs iron or steel equipment, even sulphuric and nitric acids being handled in iron vessels. Concentrated oxidizing acids render the iron passive and immune to attack. The cast iron in chemical equipment is a special alloy with less carbon, more silicon, and significant amounts of nickel, copper, and other metals. Iron containing 15 per cent silicon resists most acids. Special alloys of iron and chromium, some containing nickel, resist corrosion at high temperatures and pressures. Copper, lead, nickel, aluminum, and chromium are important metals in chemical equipment. Some processes require equipment lined with glass or with acid-proof brick or made of chemical stoneware. Other construction materials are carbon, wood, cloth, plastics, and rubber.

Chemical engineers view chemical manufacturing as a series of unit chemical engineering operations. These include the handling or flow of materials, the flow of heat, crushing, grinding, mixing, screening, filtering, evaporating, distilling, drying, and a few other operations of major importance. A still larger number of minor unit operations complete the field with which chemical engineers are concerned. Much special equipment for unit chemical processes has been designed, but most chemical manufacturing uses standard types of equipment for the common unit operations.

In the field of unit operations the pressure of war resulted in several new techniques which have been retained in the postwar period. In order to separate the isotopes of uranium the principles of gaseous diffusion through fine orifices were applied for the first time on a large scale, and this unit operation may become very useful in separating all sorts of gases of different densities. Porous membranes, the openings of which are submicroscopic, are used. A large number of such barriers separate the equipment into a

series of chambers. A part of the contents of a chamber diffuses forward into the next chamber, while the remainder is returned to pass again through the rear barrier. By sufficient repetition ultimate separation is effected. Where there is a great difference between densities, separation is relatively rapid and very few stages are required. The separation of the hexafluorides of uranium with molecular weights of 349 and 352 represented the ultimate in difficulty of separation and required millions of passages.

Induction electrical heating is applied in industries as varied as in the destruction of molds and enzymes in bread and fruits, the curing of synthetic resins in laminated products, the vulcanization of rubber, and the heat treatment of alloys.

Vacuum distillation under greatly reduced pressure has made possible separations of heat-sensitive substances, such as glycerides and vitamins, and similar low pressures have permitted the conversion of frozen fruit juices, blood plasma, and penicillin solutions to water-free solids without decomposition.

The technique of conveying finely divided solids in gases, after the solids had been brought to any desired temperature, was developed in the petroleum industry, but is being applied in other industries both to bring catalysts into contact with reacting gases and to control gaseous temperatures during reactions. See also *CHEMICAL ENGINEERING*.

There is no attempt in the following discussions of the leading chemical industries to make rigid classification according to any system.

Sulphur and Sulphur Products.—Some elemental sulphur is employed directly in fertilizers, insecticides, and explosives, and in the compounding of rubber, but more than four fifths of it is burned with air to sulphur dioxide, which in turn is very largely converted into sulphuric acid. Three fourths of the world's supply of sulphur comes from the Texas and Louisiana coasts on the Gulf of Mexico. It is found in limestone deposits above some of the salt domes of this region. The sulphur is melted by water heaters under pressure and is pumped to the surface by compressed air. This process was developed by Herman Frasch in 1902. The production of sulphur from these underground deposits amount in normal years to between 4 and 5 million tons.

Sulphur dioxide is made by burning sulphur and such sulphides as those of iron, copper, and zinc in air. Unless their location compels avoidance of damage to vegetation, smelters discard several times as much sulphur dioxide as the convert into sulphuric acid.

Liquid sulphur dioxide is a valuable refrigerant, and lamp oils and automobile lubricants are refined by extraction with it. Some chemicals such as hydrosulphites are made from sulphur dioxide. About one fourth of the total production is in the "cooking acid" of the paper pulp industry.

Sulphuric acid is made from sulphur dioxide by two methods: the *contact* and the *lead chamber* (or *nitration*) processes. It is very easy to oxidize sulphur to sulphur dioxide, but it is more difficult to attain the higher degree of oxidation.

In the contact process the gases from sulphur or pyrite burners, composed of 7 to 10 per cent sulphur dioxide, 11 to 14 per cent oxygen, and 76 to 82 per cent nitrogen, are carefully purified and passed over a catalyst to induce the reaction: $2\text{SO}_2 + \text{O}_2 = 2\text{SO}_3$. The catalysts now in use

eral use are finely divided platinum, spread on some inert material, and complex vanadium compounds. The gaseous mixture is cooled and passed through towers packed with clay shapes, over which 98 per cent sulphuric acid is flowing. The sulphur trioxide combines with the water in the absorbing acid to form sulphuric acid: $\text{H}_2\text{O} + \text{SO}_3 = \text{H}_2\text{SO}_4$.

The older lead chamber or nitration process still makes a significant amount of the sulphuric acid in the United States. It depends on causing sulphur dioxide, water, and oxygen to combine in the presence of a mixture of nitric oxide and nitrogen dioxide, which is commonly given the formula N_2O_3 . The complex substance so formed is decomposed by water into sulphuric acid and the oxides of nitrogen. These oxides are used again and again with some unavoidable losses. The process is performed in a series of towers and large lead rooms called chambers, which are supplemented by tanks, coolers, fans, and pumps. The product of the chambers is 60 per cent sulphuric acid, which is concentrated by hot burner gases to 80 per cent material. The waste gases from the chambers are scrubbed with strong sulphuric acid to recover the nitrogen oxides, which are returned to the process.

Sulphuric acid, like many other commercial liquid products, is described in terms of its specific gravity in the Baumé (Bé.) scale. Common varieties are 50° Bé. (1.53) or 62 per cent; 60° Bé. (1.71) or 77.7 per cent; and 66° Bé. (1.84) or 93.2 per cent. Oleum refers to solutions of sulphur trioxide in sulphuric acid. The larger part of all sulphuric acid is made from sulphur, most of the remainder from pyrites, and only a small fraction from byproduct sulphur dioxide.

More than half of all sulphuric acid is consumed in the manufacture of fertilizers and chemicals. The refining of petroleum, the recovery of coal byproducts, removal of mill scale from iron and steel, nonferrous metallurgy, paints and pigments, rayon, cellulose film, and explosives consume most of the remainder. Sulphuric acid is used in greater quantities than any other chemical. Its sales offer an excellent index of business conditions. The production of sulphuric acid in terms of 100 per cent material is of the order of 10 million tons per year. Until World War II all production data for sulphuric acid were given in terms of 50° Bé. acid (62.2 per cent) rather than in 100 per cent, which since has been the practice.

Ammonia and Nitric Acid.—Nearly four fifths of air is nitrogen, yet until the 20th century the world depended for nitrogen compounds on certain deposits in the uplands of Chile and on the fraction of one per cent of combined nitrogen recovered from coal gas. Man's continued existence depends on the fixed nitrogen derived from meat, milk, and plant seeds. Agriculture removes fixed nitrogen from soil more rapidly than soil bacteria can replace it from the air. Probably 85 per cent of all nitrogen compounds in peacetime are applied to the soil in mixed fertilizers.

The larger part of all industrial nitrogen compounds may be regarded as derived from the nitrogen of the air. Ammonia from coal carbonization is limited by the demands of the steel industry for blast furnace coke. Chilean nitrate accounts for only a small fraction.

The reaction, $\text{N}_2 + 3 \text{H}_2 = 2 \text{NH}_3$, appears simple enough, but yields only the merest trace

of ammonia in ordinary laboratory apparatus. Because the volume is reduced by one half when ammonia is formed, high pressures increase yields greatly. The catalyst is a spongy and active iron mass containing small amounts of aluminum and potassium. The best temperature is 500°C. Speed and yields are balanced against each other so that the largest possible quantity of ammonia is made in a given time. Yields per pass vary from 10 to 50 per cent depending on the pressure. Nickel and chromium alloys of iron are required. Pressures vary from 1,500 to 15,000 pounds per square inch.

Nitrogen is generally separated from oxygen by burning out the oxygen with carbon or hydrogen and absorbing or condensing the products, but some is distilled from liquid air. Hydrogen sources include electrolytic hydrogen, coke oven gas, natural gas, and water gas, which last equals in amount all other sources.

The larger part of ammonia is made into ammonium salts such as the sulphate. Liquid ammonia is a refrigerant and also a widely used alkaline material in the chemical industry.

Considerable quantities of ammonia are made into nitric acid. Ammonia and air are passed over red-hot platinum gauze, forming nitric oxide, NO, and water. The nitric oxide is cooled, oxidized to NO_2 , and with water formed into nitric acid, $3 \text{NO}_2 + \text{H}_2\text{O} = 2 \text{HNO}_3 + \text{NO}$. The nitric oxide is repeatedly oxidized and absorbed under pressure in nickel-chromium alloy towers. The 40 per cent water is removed with sulphuric acid, nitric acid distilling from the heated mixture.

Formerly most nitric acid was made by mixing Chilean sodium nitrate with sulphuric acid and distilling the nitric acid. Economic conditions have so changed that some sodium nitrate now results from the action of nitric acid on soda ash.

More than two thirds of all nitric acid goes into explosives, while the dye, lacquer, and plastics industries consume most of the remainder.

Nitrogen also is fixed in considerable quantities at a high temperature by calcium carbide. The reaction is $\text{CaC}_2 + \text{N}_2 = \text{CaNCN} + \text{C}$. The major product, calcium cyanamide, is mainly an ingredient of commercial fertilizers, but many important nitrogen compounds are made from it.

Fixed nitrogen production in the United States is of the order of 1.5 million tons, the larger part of which is utilized in mixed fertilizers or is applied directly as ammonia.

Alkalies.—Caustic soda and soda ash are the most important alkalies. Caustic soda (sodium hydroxide) is a byproduct in the manufacture of chlorine from salt. About three fourths of the commercial supply of caustic soda comes from this source. The remainder is made by treating a solution of sodium carbonate with a suspension of slaked lime: $\text{Na}_2\text{CO}_3 + \text{Ca}(\text{OH})_2 = \text{CaCO}_3 + 2 \text{NaOH}$. The calcium carbonate is washed free from caustic, reburned to quicklime, and slaked for re-use.

The chief consumers of caustic soda are the rayon, film, soap, petroleum, paper, and chemical industries. Production of this chemical is between 2.2 and 2.3 million tons per year.

Although some decahydrate, $\text{Na}_2\text{CO}_3 \cdot 10 \text{H}_2\text{O}$, is sold, most sodium carbonate appears on the market in the dry form as soda ash. It is made almost entirely by the Solvay process from sodium chloride. Brine is saturated with ammonia and treated with carbon dioxide gas. Ammonium

chloride remains in solution, while sodium bicarbonate, NaHCO_3 , is removed and converted to the carbonate by heat. Ammonia is recovered by slaked lime with very little loss. Small quantities of sodium carbonate are refined from the natural deposits of the Southwestern states.

Soda ash production reached a peak of 4.8 million tons in 1947. Its chief uses are in the manufacture of chemicals, particularly caustic soda, and in the glass industry. It is also important in the soap, paper, and nonferrous metal industries.

Chlorine and Hydrochloric Acid.—Chlorine is made from concentrated salt solutions by the passage of an electric current. Commercial cells, except those employing mercury cathodes, allow 40 per cent or more of the salt to pass through unchanged; a steady flow of brine and diaphragms of asbestos at the cathodes prevent backward diffusion of the caustic soda and reaction with chlorine at the anodes. Cathodes are perforated iron sheets and anodes are usually made of carbon. The two byproducts of chlorine cells are caustic soda and hydrogen.

At one time most chlorine was converted by lime into a crude calcium hypochlorite called bleaching powder. Modern bleaching powders contain both the double chloride-hypochlorite and the hypochlorite, $\text{Ca}(\text{OCl})_2$. Most chlorine is compressed and cooled to a liquid which is transported in cylinders and tank cars. Over 90 per cent of all chlorine is used in the making of chemicals and in bleaching paper and textiles. The remainder is mainly employed in disinfecting sewage effluents and public water supplies.

Some hydrogen chloride is a byproduct of the chlorination of hydrocarbons and some is made by burning hydrogen in chlorine, but most of it is made directly from salt and sulphuric acid. The gas is extremely soluble in water, its solutions being called hydrochloric or muriatic acid. Commercial hydrochloric acid is usually the 20°Bé. grade containing 31.5 per cent by weight of hydrogen chloride.

Chlorine production has continued to increase since the end of the war, amounting in 1949 to over 1.7 million tons. In terms of 18°Bé. acid containing 28 per cent hydrogen chloride dissolved in water, almost 1.6 million tons of hydrochloric acid were produced in 1949.

Bromine, Iodine, and Fluorine.—For many years the chief source of bromine in the United States was brine wells in Michigan. Increased demands for this substance led to the development of a process for extraction from sea water. Iodine is largely imported from Chile, where it is a byproduct in the refining of sodium nitrate from natural deposits, but considerable quantities are being made from oil well brines in California. Both substances are used primarily in the production of chemicals. Since 1940 fluorine, no longer a laboratory curiosity, has been produced in considerable quantities by the electrolysis of anhydrous sodium fluoride and sodium hydrogen fluoride. Although extremely reactive and corrosive, it enters into the manufacture of several organic derivatives including refrigerants and plastics. Hydrogen fluoride, once employed mainly to etch glass, is a common catalyst in the synthesis of high-grade gasoline.

Lime and Gypsum.—Vast quantities of limestone are used in making quicklime and portland cement and as a flux in the metallurgical industries. Heat decomposes limestone into quicklime

or calcium oxide and carbon dioxide. This is done in either stationary vertical or horizontal rotating kilns. Water converts the oxide to hydroxide or slaked lime, a valuable alkaline material about equally distributed among the chemical, agricultural, and building industries.

Gypsum is dihydrate of calcium sulphate. Careful heating removes three fourths of the water, leaving the hemihydrate, $(\text{CaSO}_4)_{\frac{1}{2}} \cdot \text{H}_2\text{O}$ (or plaster of paris), the main component of many wall plasters. Plaster of paris sets by absorbing water to form the dihydrate. Gypsum and slaked lime divide the plaster market, while gypsum wallboard is an important construction material.

Miscellaneous Heavy Chemicals.—Other important sodium salts include: sodium sulphate for the glass and paper industries; sodium sulphide, made from sodium sulphate for the dye industry; sodium silicate for adhesives and cleansers; the sodium phosphates in water treatment and with soaps; and sodium borate for the glass industry. Magnesium, zinc, copper, aluminum salts, and many other compounds have important places in the chemical industries.

Industrial Water Treatment.—Water supplies for industrial use and particularly for raising steam often require some type of chemical treatment. Suspended matter is removed by adding iron and aluminum salts with sufficient lime to make the water alkaline and to ensure a floc to aid in filtering. Calcium and magnesium salts have been removed or greatly reduced in concentration by the old and still quite common process of treatment with soda ash and lime in proper amounts, preferably with heating the water. The next development in industrial water treatment was to pass hard water through a bed of zeolite, a sodium aluminum silicate. Sodium was exchanged for calcium and magnesium with practically complete removal of these ions but with little reduction in dissolved solids. The filter bed was readily regenerated by soaking it in a strong sodium chloride solution. A series of organic resins have been developed, some of which will replace calcium and magnesium ions by hydrogen ions and others, containing amino groups will remove the entire acid molecule, thus taking out the acid radicals, such as chloride and sulphate, and leaving the water almost free from all dissolved substances. These base- and acid-exchange resins are regenerated readily by acids and alkalis respectively. This method of ion exchange and removal is applied both to laboratory research and commercial production in several chemical fields.

Considerable progress in water conditioning has been made by employing small quantities of sodium hexametaphosphate to prevent formation of scale in condensers and by adding larger amounts of the same substance to avoid formation of insoluble metal soaps in hard water in laundering and to suppress concentration of calcium ions in steam boilers to a point where calcium sulphate scale will not form.

Paint Pigments.—The most widely used insoluble solids composing about half the volume of paints are lead, zinc, barium, and titanium compounds. White lead is a basic carbonate; litharge and red lead are oxides of lead. Lithopone is a mixture of barium sulphate and zinc sulphide. Zinc oxide, a paint pigment, is extensively compounded with rubber in the tire industry. Colored pigments may be true chemical compounds or dyes absorbed on inert substances.

Fertilizers.—The most important nitrogen product in the fertilizer field is ammonium sulphate. Other nitrogen compounds in this industry are ammonium nitrate, phosphate and chloride, urea, calcium cyanamide, sodium nitrate, and calcium nitrate.

For many years Germany, and later Germany and France, had a world monopoly of the potash market, but in the period immediately preceding World War II the United States produced from California brines and New Mexico deposits at least half of the potassium compounds needed for agriculture. Only limited amounts of potash are imported into the United States, where production is between 1.3 and 1.4 million tons in terms of K_2O , most of which is sold to the agricultural industry.

Phosphates are used in larger amounts than any other type of plant food in mixed fertilizers. The raw material is a complex phosphate fluoride of calcium called phosphate rock. Treatment with acid is necessary in order to form substances that can be assimilated by plants. The product of mixing ground phosphate rock with $50^\circ B\acute{e}$. sulphuric acid is superphosphate. It contains beside silica and calcium sulphate mainly monocalcium phosphate, $Ca(H_2PO_4)_2$, and dicalcium phosphate, $Ca(HPO_4)_2$. Smaller amounts of a product with much higher phosphorus content, known as triple superphosphate, are made by treating phosphate rock with phosphoric acid. This acid may be made from phosphate rock by employing sufficient sulphuric acid, filtering, and evaporating, but some is made by burning phosphorus. The United States has vast reserves of phosphates, to which new processes involving flotation methods have added greatly by making lower-grade materials available.

Acidity of superphosphates may be reduced and valuable plant foods may be added by ammonia liquor or a solution containing water, ammonia, and urea.

In some years as high as 18 million tons of fertilizer materials have been sold in the United States. The plant food in mixed fertilizers in terms of nitrogen, N, phosphoric acid, P_2O_5 , and potash, K_2O , is about one eighth of the weight of the material as it is applied to the soil. A part of the remainder consists of necessary carriers, such as sulphate, chloride, and calcium, but large quantities of inert material are included to facilitate distribution. But some plant foods, such as ammonia, are applied in relatively pure form.

Glass.—Any hard, noncrystalline product of fusion is technically a glass. Commercial glasses have no true melting point, but pass from hard solids through a waxy consistency to a freely flowing liquid. Fabrication of glass is achieved so rapidly that crystallization is avoided. Glass must also have smoothness, hardness, resistance to solution and chemical action, and for most purposes either transparency or translucence. Low coefficients of expansion are necessary in laboratory and ovenware subjected to sudden heat changes.

Silica, SiO_2 , is the main acid oxide of commercial glasses, while calcium oxide and sodium oxide are the basic oxides. The chief sources of sodium oxide are soda ash and sodium sulphate (salt cake). Sodium sulphate is reduced by carbon to sodium sulphite in order that combination with silica can take place. Litharge and red lead impart high brilliancy to cut glass. Other substances in colorless glass are magnesia,

potash, zinc oxide, alumina, and boron compounds. Such materials as fluorspar, cryolite, tin oxide, and calcium phosphate remain in colloidal suspension and render glass opaque. Etching is accomplished by the action of hydrofluoric acid; designs are also ground on glass surfaces.

Colored glass is made by colored compounds of cobalt, iron, and chromium, and colloidal size particles of selenium, carbon, copper, and gold. Undesirable colors from impurities may be corrected by other colors.

A type of glass which breaks into rounded fragments rather than sharp slivers is made by special annealing, so that there is tension within and compression at the surface. Most safety glass, however, is made of two or more layers of ordinary glass cemented together by one or more layers of a transparent and colorless synthetic plastic, preferably one which does not become brittle when cold. Vinyl resins meet this requirement. Inclusion of tiny crystals of certain organic compounds in the plastic sheet and drawing the material to cause uniform arrangement of the crystals is the principle of a polarizing sandwich glass for goggles, car lenses, and windshields.

Other important developments in the glass industry include foam and fiber glasses and organic silicon compounds known as silicones.

Cellular glass is extremely light and is used in floats and as a heat-insulating material. Loose glass fibers function in filters, in distilling columns, in life preservers as a substitute for kapok, in cold-resisting clothing, and as heat insulation. Woven into cord and fabric, glass fibers serve as reinforcers of rubber and plastics in bandages which replace plaster casts, in electrical insulation, and in body armor which is efficient against shrapnel. Organic silicones as plastics, reinforced by glass cloth, have remarkable mechanical and electrical properties which greatly reduce the weight of motors and dynamos. Silicones vary from viscous fluids functioning as lubricants to rubberlike materials for heat-resisting gaskets and are also ingredients of heat-resisting paints and varnishes.

Laboratory and ovenware are borosilicate glasses with very low coefficients of expansion. A resistant glass is made from a melt which, after cooling and shaping, separates into two kinds of particles, one of which is dissolved in acids and the other is heat-treated until it has softened into a homogeneous state. Although there is shrinkage of about one third, the article retains its shape.

Small batches of glass are melted in open or covered porcelain pots, but most glass is made in large furnaces called tanks. Gas and oil are the common fuels. The ingredients, along with coarsely ground glass from rejected or broken articles (cullet), are fed intermittently at one end of the tank. By the time that chemical action is complete and the gases so produced have escaped, the molten glass flows through an opening in a wall across the tank, so that scum is stopped and clear glass collects at the working end of the furnace.

Glass articles are formed by a variety of drawing, blowing, pressing, or molding operations, most of which are performed by automatic and continuous machinery. The finished articles are reheated to relieve strains and are cooled gradually, a process called annealing.

Closely related to glass are fused coatings on

metals known as vitreous enamels. A powdered glass is mixed with clay and other pigments and either is applied dry to hot metal or is sprayed in suspension on cold metal, followed by heating in a furnace.

Nonsilicate glasses are of two types. Some lenses, said to have remarkable light-bending properties, are made from compounds of tantalum, tungsten, and lanthanum. Where resistance to hydrofluoric acid is necessary and transparent plastics are not suitable, a glass composed mainly of phosphoric pentoxide and small amounts of metallic oxides is said to have all the desirable properties of silicate glass.

Fused silica, although expensive and hard to fabricate, has many desirable properties. It does not soften at a point at which all commercial glasses will flow; it has an extremely low expansion coefficient; it resists the action of many corrosive chemicals. The usual procedure for fused silica is to imbue a resistor in a pile of sand until there is sufficient melting to permit formation of a sort of tube which is worked into shape by the usual operations. Occlusion of small gas bubbles causes opacity. Clear fused silica is made in an electric furnace from which gases may be almost wholly exhausted. Remaining bubbles collapse when pressure is restored. See also FIBERGLAS; GLASS, NON-REFLECTING; GLASS, VARIETIES OF; GLASSMAKING.

Clay Products.—Clays are mainly hydrated aluminum silicates with minor amounts of iron, magnesium, calcium, sodium, and titanium compounds. Nonplastic material, including flint, feldspar, and ground burnt clay, is necessary to permit proper shaping, drying, and firing. Refining is accomplished by grinding, flotation, removal of grit, coagulating, screening, and drying.

The clay is mixed with nonplastic materials, preferably with removal of air, and for some kinds of products is stored damp for several months. This permits combination of water and development of substances by bacterial action to improve plasticity. Clay articles are formed either by hand or by casting, pressing, or molding, and are very carefully dried. This involves some shrinkage, for which allowance must be made in shaping. The next step is firing in intermittent or continuous kilns. Complex chemical changes take place during this operation. Water is removed from hydrates; either oxidation or reduction, depending on kiln conditions, occurs; some silicates dissociate and others form; some products crystallize, but others fuse and unite the solid grains. Clay products include brick, tile, terra cotta, pottery, stoneware, chemical stoneware, porcelain, and refractories.

Portland Cement.—The following definition of portland cement is generally accepted by industry. "Portland cement is a finely pulverized material consisting of certain definite compounds of lime, alumina, and silica, which when mixed with water has the property of combining slowly with water to form a hard, solid mass."

Portland cement is made from two types of materials. The chief component of one is calcium carbonate and that of the other is aluminum silicate containing some iron. Limestone, marl, chalk, and calcium carbonate wastes furnish calcium carbonate, while silicates come from clays, shale, or blast furnace slag.

The raw materials are crushed, ground, and finely pulverized. If ground in water, the thin slurry is often thickened or filtered. Flotation

methods permit the rejection of excessive alumina and silica and the utilization of lower-grade rock.

Modern cement kilns are refractory-lined steel cylinders, sometimes over 400 feet long and from 6 to 12 feet in diameter, slightly inclined from the horizontal, and driven slowly by a girth gear. Kilns are equipped with dust chambers, waste heat boilers, exhaust fans, and stacks. Fuels are oil, gas, or powdered coal.

As the raw materials move down the kiln, water is driven out, calcium carbonate decomposes, and exothermic reactions between the ingredients occur. The hot clinker falls from the kiln and either is spread in thin layers to cool or is passed through rotating shells to preheat entering air.

The principal compounds in portland cement clinker are tricalcium silicate, $3\text{CaO} \cdot \text{SiO}_2$ (one half); dicalcium silicate, $2\text{CaO} \cdot \text{SiO}_2$ (one fourth); tricalcium aluminate, $3\text{CaO} \cdot \text{Al}_2\text{O}_3$, and tetracalcium aluminoferrite, $4\text{CaO} \cdot \text{Al}_2\text{O}_3 \cdot \text{Fe}_2\text{O}_3$ (one fifth together). A little magnesia, free lime, and sodium and potassium compounds comprise most of the rest. Before grinding, 3 pounds of gypsum are added to each 100 pounds of clinker to retard the setting.

Portland cement is mixed with from three to eight times its weight of sand and rock to form concrete. The volume of water approximately equals the combined volumes of sand and rock. Mixing is in a rotating shell. Setting and hardening result from definite chemical changes. Water combines in hydrates and decomposes silicates and aluminates into compounds with less calcium. Most of the final compounds are colloidal gels which harden slowly. Tricalcium aluminate reacts rapidly with the evolution of heat, but gypsum lessens the rate. The initial set caused by the aluminate is followed by slow changes in the silicates. Tricalcium silicate reacts first, and quick-hardening cements contain extra amounts of this compound. Finer grinding accelerates hardening. Large masses of concrete must be kept cool in summer during initial setting by reducing calcium aluminate proportions or by cold brine in pipes. Where great tensile strength is required, as in construction, concrete is reinforced by corrugated steel rods or bars which have the same coefficient of expansion.

Electric Furnace Products.—Electric furnaces (q.v.) furnish the high temperatures necessary for several important chemical products. Impurities are reduced and removed from aluminum ore in a combination arc and resistance furnace during production of refractory and adhesive grades of alumina. Both graphite and silicon carbide are made in a long resistance furnace. Carbon powder, rods, or plates serve as the resistor. Iron carbides decompose into graphite and free iron, which functions repeatedly. Silicon carbide, SiC , is formed from a mixture of coke, sawdust, and sand around a carbon resistor. A "smothered arc-resistance" furnace makes calcium carbide, CaC_2 , from lime and carbon. Phosphorus results from the reduction of calcium phosphate by carbon in the presence of silicon as a flux. Phosphoric acid is prepared by burning the phosphorus vapors in air, adding water, and collecting the mist of phosphoric acid with electrical precipitators.

Metals and Alloys.—The amount of chemistry involved in smelting and refining operations and the number of chemists employed justify a brief consideration of metals and alloys here.

Arranged in order of maximum production in the United States, magnesium, aluminum, zinc, lead, copper, and iron (q.v.) are the most important metals. The production of other metals sufficiently resembles that of any of these six to make their discussion unnecessary.

Magnesium was produced before World War II only to the extent of a few thousand tons annually. The rapid growth of the aircraft industry and the researches which overcame all the difficulties originally impeding use of this metal caused a vast growth in its production. The total capacity of magnesium plants in the United States was increased to 300,000 tons per year, and at the peak nearly 250,000 tons of the metal were made in one year. Since peacetime requirements were estimated at about 12,000 tons yearly, many magnesium plants became idle after 1945.

The leading process for making magnesium involves the electrolysis of fused magnesium chloride, a large part of the raw material being derived from sea water. Magnesium hydroxide is precipitated from ocean brine by the use of lime and the hydroxide is converted to chloride by hydrochloric acid. This necessitates large chlorine plants, the hydrogen chloride being made by the reaction of chlorine with methane of natural gas. Other processes include production of magnesium chloride from magnesite, with subsequent electrolysis, and reduction of magnesium oxide by carbon or ferrosilicon.

Aluminum is liberated from its oxide in a bath of molten fluorides by electric current. It is also refined by a somewhat similar method. A thin but very impervious oxide layer protects aluminum from corrosion. Its alloys require a coating of the pure metal. About half of all aluminum is alloyed with small quantities of copper, manganese, and magnesium. Yearly production prior to 1940 in the United States averaged around 100,000 tons. During the war this figure was increased tenfold. Processes permitting the use of lower-grade bauxite were developed. Alumina (q.v.) in large quantities was recovered from the "red muds," wastes from previous operations for extraction of sodium aluminate from bauxite. Yearly production of aluminum in the United States averages considerably over 600,000 tons since 1945.

Zinc.—A considerable fraction of zinc is burned in the air to zinc oxide or made into salts. Much larger amounts are marketed as free metal. Zinc sulphide is roasted to the oxide, which is then handled as other zinc ores. The general principle of zinc metallurgy is the reduction of the oxide by carbon in retorts, condensation of the vapors, and burning the waste carbon monoxide. Casting zinc is alloyed slightly. Other metals are often coated with zinc. Brass, a copper alloy, contains about 30 per cent zinc. Production of zinc has at times reached 900,000 tons per year in the United States and in 1949 was about 600,000 tons.

Lead comes largely from sulphide ores. Part of the sulphur is removed and the ore is heated with coke in a blast furnace. A mixture of sulphides, mainly those of copper, is separated from molten lead. Pure lead is the product of an electrolytic process, but most lead is refined in furnaces. Some impurities are skimmed, usually as oxides, and silver is extracted by zinc. Most lead is never alloyed, but some "hard lead" is made by adding antimony or tellurium. Lead is a component of solders. United States produc-

tion varies from 300,000 to 1,000,000 tons, of which less than half is new metal produced from ores.

Copper.—As many as 1,000,000 tons of copper have been produced from ores in this country in a year, but there have been years in which less than one fifth this amount has been produced. Since 1945 production varies between 750,000 and 850,000 tons, or about one third of world production. Approximately as much copper is recovered from scrap as is made from ore. Most copper ores are low grade, but concentration methods such as flotation have made recovery easier. Considerable quantities of copper are extracted with sulphuric acid, but furnace methods are more common. Sulphur is partially removed by roasting concentrates and the ore is processed either in blast furnaces or more commonly in reverberatory furnaces. The first product is a mixture of sulphides of iron and copper. Air is blown through the molten sulphides in a converter until all the iron has lost its sulphur and its oxide has formed a silicate slag. This is poured off and the sulphur burned out to leave a crude copper known as blister copper. Further refining in a furnace removes most impurities, but leaves cuprous oxide dissolved in the copper. This is reduced to copper by the trunks of green young trees. Final refining for metal to be used in electrical transmission and equipment is an electrolytic process, whereby impure copper anodes are dissolved and pure copper is plated on sheet anodes. The major byproducts are nickel, silver, and gold.

Iron.—Production of iron and its alloys, mainly steel, is several times that of all other metals combined. Iron rivals aluminum in abundance and is much more easily recovered from its ores. The magnetic properties of iron have been the foundation of electrical industries. Since iron is easily corroded in moist air, rust losses in the world annually amount to billions of dollars. Scrap iron is remelted so that only a part of production is new metal.

The properties of pure iron are readily changed by small amounts of other elements, particularly carbon. Iron occurs in two modifications with different atomic spacings. The one stable up to 910°C. does not dissolve appreciable amounts of carbon in solid solution, whereas the high temperature modification dissolves this element up to 1.7 per cent. A large part of the physical metallurgy of steel depends on the transformation of one form of iron into another and the effects of carbon. When cooling is rapid, "gamma iron" changes into "alpha iron," but carbon is retained in a supersaturated solution, which is extremely hard. Reheating permits rejection of iron carbide and the steel is softer and more ductile. Other elements are of value chiefly in regulating the transformation of iron, although some form impermeable oxide layers.

Iron ores (largely Fe_2O_3 and silica), mixed with coke and limestone, are heated in a strong current of air in a blast furnace. The product is pig iron which contains as much as 4 per cent of carbon and smaller amounts of silicon, phosphorus, and sulphur. Many articles and machine parts are made from pig iron by casting. Heat treatment makes the crude iron more malleable. Wrought iron is a furnace-refined metal with about 0.1 per cent of carbon and other elements. It is being replaced largely by mild steel.

Steelmaking involves the removal of most of

the carbon and other elements and the addition of the correct amount of alloying substances. In the pioneer Bessemer method of making steel, now used to a relatively small extent, a powerful current of air was blown through the molten metal until the carbon was consumed and the silicon and other elements were oxidized and formed a slag. This required only a few minutes, but was limited to 8 to 15 tons at a "run." Some iron oxide formed, but was reduced by aluminum and other deoxidizers. Alloying elements were added to the molten metal. In the open-hearth process from 100 to 150 tons of metal are handled during a run of several hours. The impurities are removed in a reverberatory furnace by an oxidizing slag, in which iron oxide is dissolved, until about the correct amount of carbon remains. After tapping, deoxidizers reduce the oxides in the final product and alloying elements are introduced. Electric furnaces are increasingly employed in the preparation of special steels.

Production of ingot steel reached a peak of slightly more than 90 million tons in 1944, with a corresponding production of pig iron of 61 million tons. Steel of all types reached a production figure of nearly 78 million tons in 1949, or 81 per cent of capacity. A large part of all steel is made from scrap. See also ALLOYS; STEEL.

Coke and Gas.—All anthracite coal and four fifths of all soft coal are burned directly as fuels. Certain types of bituminous coal are heated to temperatures up to 1800°F. to produce gas and coke. One ton of coal will yield about 1,400 pounds of coke and from 11,000 to 13,000 cubic feet of coal gas. Byproducts include mainly tar, ammonia, and light oils.

Coke.—The larger part of coal carbonization is performed in byproduct coke ovens. These are long, deep, narrow chambers of silica brick which can hold several tons of coarsely ground bituminous coal. From 10 to 50 ovens form a battery. Between and over the ovens are flues, through which burning producer or coke oven gases pass. After 12 to 18 hours of heating, the ends of the ovens are removed and a powerful ram pushes the red-hot coke into a car for transportation to quenching equipment. Coke, being hard, strong, and porous, is good blast furnace fuel. Fusion causes the coke to form long, irregular blocks.

The gas passes through a purifying operation whose completeness is determined by the required quality of the gas and the demand for byproducts. Tar is removed by condensers, perforated baffles, or electrical precipitators. Ammonia is usually scrubbed from the gas by water or sulphuric acid. Sulphur compounds, mainly hydrogen sulphide, are removed if the gas is marketed. Many plants still employ hydrated iron oxide, but in modern processes solutions containing catalysts recover sulphur as a byproduct. Naphthalene is removed to avoid clogging small orifices. If the price justifies, light oils are also recovered. Coal gas has as its main components methane and hydrogen. Its heating value is from 525 to 550 Btu., which means that burning one cubic foot will raise 525 to 550 pounds of water 1°F.

Coke production generally parallels that of ingot steel and in 1944 reached a peak of about 75 million tons. Only about one tenth of this coke was made in the older beehive type of oven. Production in 1949 was about 63.5 million tons. See also COKE.

Gas.—There is not enough coal gas for industrial and domestic needs. In those parts of the

United States where natural gas is not available, large quantities of carbureted water gas are manufactured. Water gas is a mixture of hydrogen and carbon monoxide made by alternate blasts of air and steam through beds of coke or coal. Enrichment to a figure comparable with coal gas is made by adding a rich gas made from petroleum distillates.

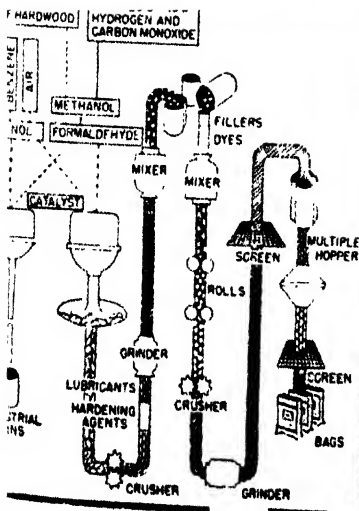
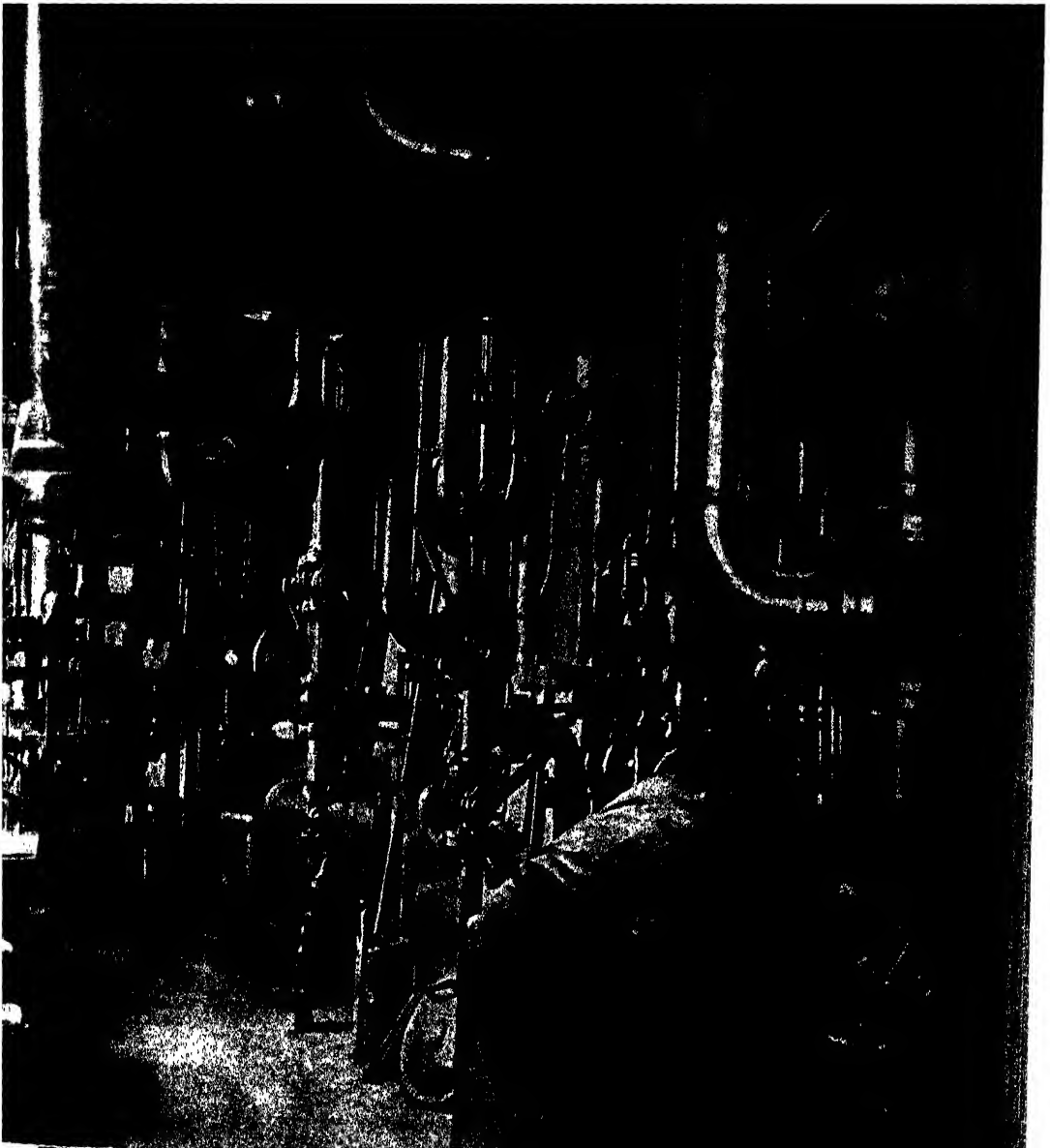
Producer gas is a cheap fuel made in the same plant where it is burned. All furnaces are essentially gas producers, the term referring to producing carbon monoxide by the action of carbon dioxide on hot carbon. In a furnace the carbon monoxide burns immediately in additional air. A mechanical producer permits the transfer of the gas to other parts of the plant before it is burned. Air is continually passed through a deep fuel bed. The carbon dioxide formed by combustion is reduced to carbon monoxide. Steam keeps down the temperature at the grate bars and some water gas is formed. If the fuel is bituminous coal instead of anthracite or coke, some coal gas is also made. Producer gas varies in heat value from 125 Btu. to 180 Btu. depending on the fuel.

Petroleum Products.—Until the demand for automobile and aviation fuels became large, the processing of petroleum was largely a matter of distillation, accompanied by some unregulated heat decomposition. In the 1940's the petroleum industry began to become a real chemical industry.

Crude petroleum is composed largely of hydrocarbons with minor amounts of oxygen, nitrogen and sulphur compounds. Only a very small part of the hydrocarbons are aromatics. Paraffins are largely limited to low-boiling substances and a small quantity of crystalline material. Naphthene ring hydrocarbons, many of which have side chains, probably represent the largest quantities of hydrocarbons in petroleum.

Distillation separates crude petroleum into typical fractions including naphthas, kerosene, gas oil, and lubricating stock. Though some batteries of shell stills have not been discarded, all refineries built since 1940 are equipped with pipe stills, or coils of pipe in a furnace. Fractionating columns permit the separation of the various fractions. The higher-boiling fractions are usually distilled under reduced pressure.

Even the best crudes contain insufficient amounts of gasoline to meet modern industrial demands. It is, therefore, necessary to break larger molecules into smaller ones. This was originally accomplished by heat and pressure alone, a process called pyrolysis (or more commonly cracking). Since more recently catalysts such as silica impregnated with phosphoric acid and more commonly various types of silicates are employed, purely thermal cracking is no longer the predominant process. Several of the largest catalytic plants in the United States use a process in which the catalyst in the form of a dust is carried as a suspension in the hydrocarbon vapors. The mixture of dust and gas flows as a fluid and requires very little pumping, the heavier column of dust-laden gas being balanced against a rising column of dust-free gas. Reaction occurs in chambers, wherein the turbulence maintains very even temperatures. Pressures in the process are very low in comparison with the older thermal cracking processes. The catalyst is readily recovered in cyclone collectors aided by electrostatic separators. Catalytic processes are



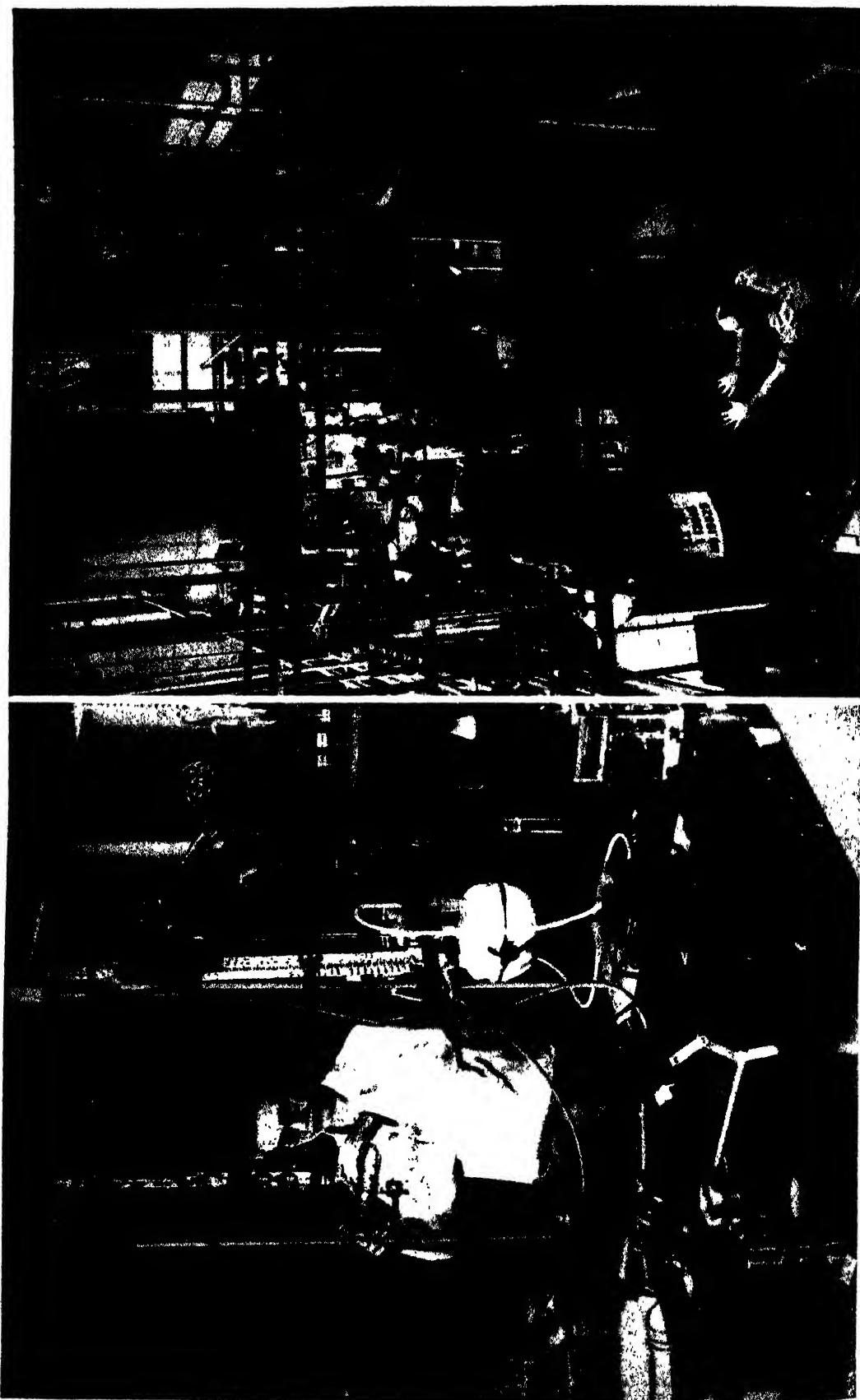
CHEMICAL INDUSTRIES

A workman keeps check on the Monsanto phenol formaldehyde process at the company's Springfield, Massachusetts, plant.

Fig. 1: Phenol formaldehyde compound process flowsheet.

Courtesy Monsanto Chemical Co.

CHEMICAL INDUSTRIES



Left: This is the frontier of the chemical industry, the laboratory where each day is a challenge to exploratory research. Right: Operators manipulating apparatus in the big plant.

Courtesy MERCK & Co., Inc.

said to be very versatile, producing at will aviation gasoline, aromatic hydrocarbons for explosives, or olefins for the synthetic rubber industry. The fluid catalyst technique has been extended to the production of phthalic anhydride from naphthalene and probably will prove useful to the chemical industry in general.

Saturated hydrocarbons are converted in vast quantities to unsaturated hydrocarbons by catalytic dehydrogenation. But it is often necessary to add a limited amount of hydrogen to certain reaction products before they are ready for use as aviation fuels. Even in the dehydrogenation operation considerable amounts of hydrogen must be present to control the reaction and to prevent its going too far. Many unsaturated hydrocarbons, mainly butadiene and ethylene, are raw materials for the synthetic rubber industry. Others are starting substances for making gasoline blending agents.

A reaction of great value in the production of the branching chain hydrocarbons so essential in the prevention of knock in internal combustion engines is known as alkylation. This involves the addition of such isoparaffins as isobutane and isopentane to unsaturated hydrocarbons, mainly butylenes, to form saturated hydrocarbons of the desired structure. Alkylation is accomplished by heat alone or more commonly by sulphuric acid or liquid hydrogen fluoride.

Unsaturated hydrocarbons with short branching chains are caused to polymerize to form longer branching chain hydrocarbons, which are liquids. These are hydrogenated to become valuable blending agents for aviation gasoline. Typical among these are iso-octane and triptane. Often two different olefins combine to form what are known as dimers. These operations are also conducted either under the influence of heat alone or with the assistance of catalysts containing phosphoric acid, silica, and pyrophosphates.

To secure an ample supply of isoparaffins the abundant straight-chain butane and pentane are subjected to mild heating in the presence of hydrogen chloride and aluminum chloride contained in fused antimony chloride. This process is known as isomerization and has greatly increased the production of aviation fuels.

Aromatic hydrocarbons are made from straight-chain paraffins by first causing the formation of cyclic hydrocarbons known as naphthenes or cycloparaffins. These are then robbed of some of their hydrogen by controlled reactions in the presence of hydrogen and catalysts until they become aromatic hydrocarbons of the same type as those gotten from coal gas and coal tar. It is estimated that to supply the aromatic hydrocarbon, toluene, for the manufacture of TNT, if it could not have been made from petroleum distillates, it would have been necessary to have increased the present coke oven capacity of the United States about 300 per cent. Obviously this would have been impossible, when it is remembered that a ton of coal yields only about one half gallon of toluene. Other aromatic hydrocarbons such as cumene are excellent blending agents in aviation gasoline. Cumene is made by combining petroleum refinery gases with benzene from coal gases.

These chemical processes yield substances of known composition and structure which are mixed with approximately equal amounts of straight run or cracked gasoline and a little lead tetraethyl to produce aviation gasolines permitting the

high speeds necessary in modern warfare. These fuels are entirely unsuited to automobile engines (as constructed up to 1951), since much smaller quantities of the blending agents are sufficient to make the highest grade gasoline which these engines are capable of using. Future automobile power plants probably will demand increasing quantities of the materials used so abundantly in aviation gasoline, with consequent increase in power and smoothness of operation, so that the developments of the war period will continue to be fruitful.

In the meantime motor fuels from petroleum may be increasingly supplemented by products derived from the action of hydrogen on carbon monoxide. Both these starting substances are readily produced from coke and steam. Such processes were used extensively in Germany during World War II. Since then these processes have been greatly improved in the United States, where several plants, both private and governmental, have been operated with the production of motor fuels and synthetic organic chemicals in commercial quantities. Because of the abundance of natural gas, methane has been substituted for coke as the source of carbon in these pioneer plants.

Certain types of hydrocarbons, particularly straight chain paraffins, cause "knocking" in automobile engines. This phenomenon is a sudden sharp detonation in which the rate of burning becomes extremely rapid. Addition of a small amount of lead tetraethyl, $\text{Pb}(\text{C}_2\text{H}_5)_4$, which must be dissolved previously in ethylene dibromide, greatly reduces the knocking tendencies of ordinary gasoline. Clustered branching chains have the least tendency to knock. Normal heptane, C_7H_{16} , produces very severe knocking and is given a rating of zero, while 2,2,4-trimethylpentane, or iso-octane, rated at 100, will not knock except under very high compressions. If a fuel just barely causes knocking under the same conditions whereby a mixture of 70 per cent iso-octane and 30 per cent heptane will produce the same effect, the fuel has an octane number of 70. Toluene, an aromatic hydrocarbon, has a rating of 110, and 2,3-dimethylbutane a rating of 120.

Gumming and discoloration are prevented by adding very small amounts of aromatic amines and phenols to gasoline. The cost of such materials in a single year is about \$10,000,000, but the resulting saving is probably twice this figure.

The refining of petroleum products is also accomplished by treatment with chemicals. Gasoline is washed with sulphuric acid and a solution of litharge in caustic soda. Sulphuric acid and liquid sulphur dioxide are both employed in refining kerosene. Sulphuric acid washing of automobile lubricants is supplemented by removal of undesirable substances with liquid sulphur dioxide, furfural, dichloridethyl ether, nitrobenzene, and liquid propane.

An important use of gasoline in World War II was as the fuel of flame throwers which were carried either by troops or by tanks. The gasoline was formed into a tough and stable jelly by aluminum soaps of fatty acids, so that four fifths of the burning material reached its target rather than being consumed on the way. Jellyed gasoline was also an ingredient of most incendiary bombs used during the later part of the war.

Large quantities of isopropyl and other alcohols are made by treating refinery gases with sulphuric acid and hydrolyzing the acid sulphate.

Some of the solvents and reagents used in processing petroleum distillates are themselves petroleum products. Impressive numbers of chemicals for other industries are made from petroleum hydrocarbons, beside large quantities of solvents obtained by direct distillation. See also PETROLEUM.

Rubber.—The chief ingredient of rubber articles is a highly polymerized hydrocarbon comprising many C_5H_8 , or isoprene, units. This substance is obtained principally from the latex of the hevea tree (*Hevea brasiliensis*). Most rubber plantations are in southern Asia, but cultivation is being expanded in Africa and in Brazil. After formic and acetic acids have coagulated the latex, the resulting plastic solid is washed and dried. Some latex is spray-dried and some, preserved by addition of chemicals, is employed directly in industry. Crude rubber contains small amounts of salts, proteins, sugars, and resinous substances.

Rubber alone is not a satisfactory material because of its sensitiveness to heat and cold. Charles Goodyear (1800–1860, q.v.) is credited with the discovery that combination of rubber with sulphur greatly extends the temperature within which rubber remains tough and elastic. The process by which rubber is thus changed is called vulcanization. Soft-rubber products contain from 0.5 to 5.0 per cent of sulphur, while hard rubber has in it from 25 to 32 per cent sulphur. Other substances mixed with raw rubber in compounding are: pigments, such as carbon black and zinc oxide; colors; and tars, oils, or resins as softeners. Very small amounts of organic nitrogen and sulphur compounds regulate the rate of vulcanization and are called vulcanization accelerators. Other substances in small amounts prevent premature vulcanization and avoid cracking and disintegration because of air and light.

The rubber and other ingredients are thoroughly mixed on rolls or in powerful, closed, kneading machines, are shaped by sheeting, molding, or extrusion, and are vulcanized by heat and pressure.

Both latex and rubber suspensions in solvents are employed in processes for coating metals, impregnating cord and fabrics, and making thread, rubber gloves, and many other thin-walled articles. These processes include evaporation of solvents, coagulation by acids or zinc salts, and passage of an electric current to cause depositions on zinc forms or metals coated with zinc.

In 1941 the United States was consuming natural rubber at the rate of 800,000 tons annually. The Japanese attack at Pearl Harbor in December of that year automatically cut the United States rubber imports from the Dutch and British East Indies to a trickle. There was on hand at that time a stockpile of 700,000 tons which, with imports during the entire war period of only a fraction of a normal year's supply, served to supplement the enormous synthetic rubber program. Recovery of rubber-producing regions has been surprisingly rapid, and the United States imported 734,821 long tons of natural rubber in 1948.

Synthetic Rubber.—Within five years after imports of natural rubber had ceased, American chemists and chemical engineers succeeded in creating a new industry capable of producing annually as much synthetic rubber as the whole world had consumed of natural rubber in any

year before 1941. Until the beginning of World War II a few thousand tons per year of specialty rubbers, such as thiokol, koroseal, and neoprene, represented the entire synthetic rubber industry. The United States was wholly dependent on imported natural rubber for its tire, tube, footwear, and other fabricating industries. In 1944 nearly 800,000 long tons of synthetic rubber were synthesized, of which about 90 per cent was of the Buna S or GR-S type. The return of natural rubber led to the decline of the government-subsidized, but privately operated, synthetic rubber industry, which since 1945 has produced about 400,000 long tons annually.

In this connection it is interesting to note that the production of neoprene, the first successful synthetic specialty rubber developed in the United States in 1930, has reached since the war the rate of 60,000 long tons per year. Neoprene is made by polymerizing 2-chlorobutadiene, which in turn is made from monovinylacetylene and hydrogen chloride. The original raw materials are thus coal, limestone, and salt. Neoprene is superior to natural rubber with respect to resistance to heat, sunlight, oils, and chemicals.

This almost miraculous feat of industrial production was accomplished by selecting a single process and centering all efforts on that process. Butadiene, made from alcohol and from refinery gases, and styrene, made from coal gas benzene and ethylene from alcohol or refinery gases, are combined in the proportions of 3 to 1 in the presence of soapy water containing minor amounts of chemicals to form a latex, which is later coagulated to a mass of crumbs. The most recent process is a continuous one, considerably increasing the rate of production. The larger part of the equipment and operations in this process is required in making butadiene and styrene.

The product, Buna S or GR-S rubber, is not an exact replacement for natural rubber. In some respects the new material appears to be superior and in others it is not equal to the natural product. When it is remembered that the industry has had 100 years' experience in compounding and fabricating natural rubber as against less than 10 years' trial of the new product, comparisons are somewhat premature, and of little value.

The most significant advance in the process for making GR-S rubber has been to control polymerization at temperatures much lower than the original figure of 120°F. or thereabouts. The newer type of "cold process" rubber is commonly made at 41°F. and some is made as low as 14°F., in this case methanol being added to the reaction mixture as an antifreeze. Cold rubber is distinctly superior to the older types and fully half of synthetic plants operating in 1950 have been converted to this process.

An important ingredient in the manufacture of rubber products is reclaimed rubber. This is not wholly a substitute for new rubber, but is essential because of its peculiar properties in making certain types of rubber products. The technique of reclaiming scrap and waste rubber made from the natural variety is not wholly applicable to reclaiming synthetic rubber, but considerable progress has been made in adapting former methods and developing new ones for synthetic reclaim.

Synthetic Buna S latex compares favorably with the latex obtained from hevea trees, and considerable quantities are being used. A

portant use of latex is in impregnating cotton and rayon tire cord.

Butyl rubber, made by copolymerizing butadiene and isobutylene, is a material in which there is relatively little unsaturation. This rubber, which is strictly an American product, is specially suited to the manufacture of inner tubes for tires. These tubes hold air much better than those made from any other type of rubber and also hold helium remarkably well. Substitution of helium for air in large airplane tires means a noteworthy saving in weight. Butyl production amounts to about 70,000 long tons annually.

Other rubberlike substances are made from vinyl chloride, acrylonitrile (with butadiene to form buna N), isobutylene (with isoprene to form vistanex), and a variety of halogenated organic compounds with sodium tetrasulphide. The last-named substances have the trade name thiokol. The halogens are removed by combination with sodium, leaving sulphur in the molecules of the plastic, which then polymerize.

Plastics made in smaller quantities than buna S have special properties (such as resistance to oils, acids, and other chemicals) which have made them uniquely useful in many industries and in the fabrication of many articles. Quite often a small quantity of one or the other of these elastomers is the key to the satisfactory functioning of an entire piece of equipment. See also RUBBER, SYNTHETIC.

Oils, Fats, and Waxes.—Comparatively little in the way of chemical change characterizes the production of oils, fats, and waxes from natural sources. Important animal fats are tallow, lard, and butter. Most animal oils are fish oils. Vegetable fats are of minor importance. Olive oil and palm oil are made from the fleshy portions of the fruit, but most vegetable oils come from the seed kernels. Small seeds are crushed, but larger ones are broken up and the oil-bearing portion is separated. Edible oils include cottonseed, olive, peanut, corn, soybean, coconut, sesame, and palm. The two leading edible oils are soybean oil and cottonseed oil. The peak in production of cottonseed oil in the United States occurred in 1926, when 1.8 billion pounds of this oil were extracted from the seed. Due to reductions in the amount of cotton grown, the amount of soybean oil produced yearly exceeds that of cottonseed oil. Average figures for annual production in the late 1940's are: cottonseed oil, 1.1 billion pounds; soybean oil, 1.5 billion pounds. Linseed, tung (China wood), oiticica, and castor oils are the chief technical oils. Over 500 million pounds of linseed oil are made in the United States in an average year. Edible oils such as cottonseed oil are refined by treatment with dilute solutions of caustic soda, bleached by activated clays and chars, and are deodorized under reduced pressure by steam.

During World War II imports of oils and fats were cut to a very low figure, particularly those of Asiatic origin, such as coconut oil and tung oil. Imports of oils and fats in the 1937-1941 period exceeded exports by 1.5 million pounds yearly. During the war there was a world shortage of oils and fats. The United States normally imports the larger part of its supply of olive oil and all of its coconut oil. Only limited quantities of tung oil are produced from American-grown nuts. Both flaxseed and linseed oil imports are necessary to supplement the American supply. The United States ordi-

narily produces about 85 per cent of all the oils and fats consumed in the country and can produce all the edible glycerides required.

Waxes such as carnauba and candelilla are obtained from the leaves of tropical plants by scraping and melting. Beeswax is essentially a vegetable product.

Oils are converted into semisolid fats like lard and tallow by heating them with freshly reduced nickel and passing hydrogen under pressure through the liquid.

Fatty acids are minor products of oils and fats. Edible oil-refining residues (or "foots") are common sources of these acids, which are liberated by mineral acids. Garbage greases and wastes are broken up by enzymes or chemicals into glycerin and fatty acids, both of which are readily purified by distillation. Solid acids are called stearic acid and liquid acids are called oleic acid, although other acids are present. Fatty acids are ingredients of candles, polishes, rubber mixtures, pharmaceuticals, cosmetics, soaps, paints, and textile and leather finishes.

A shortage of drying oils during World War II was responsible for such improvements as dehydration of castor oil to produce additional unsaturation, and fractional separation by distillation under reduced pressure of unsaturated fatty acids from a mixture of acids derived from semidrying and nondrying oils. These acids were esterified with glycerin to produce synthetic drying oils.

Double bonds in soybean and linseed oils are shifted by the use of nickel oxide on carbon black as a catalyst; the resulting product is "bodied" by heat without serious loss, as is the case with alkali-refined oils. Paints made with these oils also set faster than those containing the usual type of paint oils. Fatty acids whose double bonds have been shifted to the conjugated position are esterified with polyhydric alcohols. Mild selective hydrogenation of tallow produces a material which gives a better soap for use in the synthetic rubber industry. Selective hydrogenation serves to prevent separation of oleic acid in cold pressing or fractional crystallization of fatty acids from solution. Solid and liquid fatty acids, on the other hand, are efficiently separated and separately esterified for specific purposes.

Soap and Glycerin.—Some aluminum, zinc, lead, and other heavy metal soaps are employed in industry, particularly in lubricating greases, but most soaps are sodium or potassium salts of fatty acids. Pine rosin forms a complex acid whose sodium salt is an ingredient of yellow laundry soap.

Tallow is the principal soap fat. Olive, palm, and coconut oils are valuable soap oils. Vegetable oils and fish oils are hydrogenated to substances resembling tallow. Some refinery foots are made into soaps.

The essential principle of soapmaking is heating oils and molten fats with caustic soda or caustic potash solutions. Addition of salt to the soap kettle causes a separation of soap curds. In the 1940's the old kettle process was being rapidly supplanted by continuous processes involving either production of fatty acids by high-pressure hydrolysis followed by alkali neutralization or countercurrent saponification in centrifuges. Further steps are washing, mixing with colors, perfumes, and other ingredients, drying, and finally shaping into cakes. Soap is also

marketed as a powder, as tiny, thin-walled bubbles, as a paste, and as solution in dilute alcohol.

Sulphonates and alkylaryl sodium sulphates are more expensive cleansers or detergents. These are derived largely from high-pressure hydrogenation of fatty acids to alcohols and, since 1940, more commonly by direct synthesis from petroleum hydrocarbons. They are specially useful in hard water, since their calcium and magnesium compounds are soluble. In spite of the higher price, the newer detergents are produced in quantities exceeding 700 million pounds per year. Closely akin to these are "wetting agents," which facilitate the penetration and wetting of surfaces which repel liquids. The public became aware of them through the duck which sank in water containing a wetting agent.

Glycerin is a byproduct of the fatty acid and soap industries. Unless the price is attractive, some glycerin is wasted in making soap. Washings containing glycerin are chemically treated and then concentrated, pure glycerin being separated by steam distillation under reduced pressure. Glycerin is also made by fermentation of sugar or is synthesized from petroleum refinery gases.

Sugar and Starch.—Carbohydrates are composed of simple or complex ring systems. Their chemical behavior is largely due to hydroxyl (OH) groups giving them an alcoholic character and to the carbonyl (C=O) groups developed by breaking rings. Sugars, starch, and cellulose are the best known carbohydrates.

The most important of many sugars is sucrose, $C_{12}H_{22}O_{11}$, which is present in sugarcane and sugar beets in commercially profitable quantities. This sugar is broken up by acids into the simple sugars: dextrose (corn or grape sugar) and levulose (fruit sugar). Both have the formula, $C_6H_{12}O_6$.

Sugarcane, grown extensively in semitropical and tropical regions, contains sucrose to the extent of about one seventh of the weight of the trimmed stalks. The cane is shredded, pressed, and freed of remaining sugar by addition of water and further pressing. The juice is clarified by lime, carbon dioxide, sulphur dioxide, and phosphates; it is concentrated by evaporation under reduced pressure to practically molten sugar, from which a crude brown sugar crystallizes. Heavy black molasses is a byproduct. Brown sugar is shipped to central refineries where decolorizing and recrystallizing operations result in a pure, white, crystalline product.

Sugar beets are cut into thin slices and the sugar is extracted from them by hot water. The extract is clarified in much the same way as is cane juice; evaporation and crystallization operations are similar. A white sugar is the final product. Beet molasses still contains considerable amounts of sucrose, whereas cane molasses consists mainly of dextrose and levulose. Treatment of diluted beet molasses with quicklime causes the precipitation of insoluble sucrose derivatives, from which the sugar is freed by carbon dioxide.

Starch is a complex carbohydrate composed of dextrose rings. Most commercial starch in the United States comes from corn (maize), although some is made from white potatoes and a very limited amount from sweet potatoes. The corn is softened in warm, dilute sulphurous acid, coarsely ground, freed of the tough, oil-bearing

germ and bran; the starch is separated from the protein material (gluten) by settling.

Gums and adhesives are made from starch by mild treatment with acids. The chief products are British gums and dextrin. More vigorous treatment of starch suspensions with acid solutions under pressure produces a mixture of carbohydrates including dextrin, maltose, and dextrose. The free acid is neutralized with soda, the solution is decolorized and concentrated by evaporation at low pressure to a sirup which is generally known as glucose or corn sirup. Longer boiling at higher pressures finally converts all the starch to dextrose, which is finally isolated and marketed either as anhydrous dextrose or as a crystalline hydrate under the name of corn sugar.

A somewhat similar procedure is employed with inulin, a carbohydrate found in such tubers as the Jerusalem artichoke, to prepare levulose. This sugar is present in fruits and is also formed from sucrose, but neither of these sources is economically interesting.

Alcohols.—Among several commercial alcohols the one made in largest amounts is ethyl alcohol, C_2H_5OH , often called grain alcohol. Before 1940 the larger part was made by fermentation of sugars. Fruits and grains in normal times are the common sources of alcoholic beverages, the chief source of fermentation alcohol being cane or beet molasses. During World War II this source was entirely inadequate because of the shortage of tankers for transportation from the Cuban sugar mills and particularly because of the great demand of the synthetic rubber program. More than half of the butadiene used to make buna S synthetic rubber was derived from industrial alcohol, the remainder coming from the petroleum industry. For these reasons the larger part of all industrial alcohol was made in the war years from grain.

The starch of grain is converted by enzymes to fermentable sugars which are in water solution. Blackstrap molasses is diluted and acidified to break up sucrose into invert sugar. Addition of yeast and ammonium sulphate precedes the fermentation process, which results in alcohol with the evolution of carbon dioxide. The final products, 95 per cent alcohol and 100 per cent of "absolute" alcohol, are obtained by distillation, the removal of the last 5 per cent to produce the latter grade requiring the use of benzene.

A 50 per cent by volume solution of grain alcohol in water is "proof" or 100 proof; absolute alcohol is 200 proof.

Before World War II the production of alcohol averaged annually 100 to 125 million gallons of 95 per cent material. Production in 1944 approximated 600 million gallons. Of this about one tenth was synthetic alcohol from ethylene. But the declining demand for butadiene for synthetic rubber completely changed the industrial alcohol situation. Of the 170 million gallons made in 1949, only 40 per cent was from fermentation processes, while the rest came from the action of sulphuric acid on ethylene and subsequent hydrolysis. Ethylene is a byproduct of the petroleum refinery.

Butyl, isoamyl, and other primary alcohols are also fermentation products. Secondary and tertiary alcohols are usually synthesized from petroleum refinery gases. Of these alcohols isopropyl is the most important and is produced at an annual rate of over 100 million gallons.

The simplest of the alcohols is methanol, CH_3OH . The term wood alcohol, as applied to this very toxic substance, is being discarded to avoid confusing it with grain alcohol. Until about 1920 practically all methanol came from wood distillation, but by 1949 nearly nine tenths of all methanol was synthesized at high pressure from hydrogen and carbon monoxide (water gas). The catalyst for this process contains zinc and chromium oxides. Total production of methanol in 1949 was about 125 million gallons.

Pulp and Paper.—Some paper is made from cotton and linen rags, but the larger part of it is a product of wood fiber. Mechanical wood pulp (or ground wood) is the principal ingredient of newsprint and other cheap papers. The better grades of paper are mainly made from chemical wood pulp.

Wood chips are heated under pressure in solutions of chemicals until the other portions of the wood are partially or wholly dissolved from the cellulose. The chemicals used are: sulphurous acid and calcium bisulphite (sulphite process); sodium hydroxide (soda process); and sodium sulphide and sodium hydroxide (sulphate process). Sodium sulphate, later reduced to sodium sulphide, gives the name to the sulphate process.

Regulations on stream pollution may make it necessary to evaporate sulphite liquors, with the recovery of a pitch and several valuable lignin derivatives. One of these is vanillin, also made from vanilla beans. Both soda and sulphate liquors are concentrated, the organic material burned, and the resulting ash used again in preparing solutions for the digesters.

The fiber is bleached with hypochlorites, freed of water, and formed into sheets unless a paper mill is near.

Several other substances are included with cellulose fiber in finished paper. These are: size, made from pine rosin, soap, and alum; pigments, such as white clay, talc, whiting, gypsum, and zinc and titanium compounds; and dyes.

The operations of screening, mixing the fibers with other ingredients, cutting and fraying them, and causing them to form a continuous sheet of paper or thicker paper board are all strictly mechanical operations. Coatings containing gelatin, casein, starch, and pigments are often applied after fabrication. See also PAPER.

Wood Distillation.—Hardwoods are still the source of considerable quantities of wood charcoal, acetic acid, methanol, and minor solvents. The wood is heated in closed ovens for several hours. Gas of fair fuel value escapes and is burned around the ovens. The distillate is separated by settling and further distillation into tar, oils, acetic acid, methanol, and small amounts of other organic liquids. The charcoal is cooled in airtight chambers. Much acetic acid is made from calcium carbide. Most methanol is also synthetic. Methanol from wood, because of an odor due to minor impurities, is a valuable denaturant of ethyl alcohol.

Turpentine and Rosin.—When the wood of living pine trees is chipped to a slight depth, a liquid, which is the source of turpentine and pine rosin, exudes. Collection is in earthenware cups. Distillation removes the turpentine and leaves a residue of solid rosin. Smaller amounts of turpentine and rosin are extracted by steam and solvents from dead pine stumps.

Turpentine is mainly pinene, $\text{C}_{10}\text{H}_{16}$, and rosin

consists of anhydrides of complex organic acids. The chief use of turpentine is in paints and varnishes; rosin is important in the paper and soap industries. Smaller quantities of rosin are combined with glycerin in varnish manufacture. About 30 million gallons of turpentine and 500,000 tons of rosin represent typical yearly production of the naval stores industry in the United States.

Textiles.—The two major vegetable textile fibers are cotton and linen. Both are composed mainly of cellulose. The fibers are freed from waxes and oils by dilute alkaline solutions and are bleached by hypochlorites. Cotton and linen are disintegrated by even dilute acids.

Wool is a protein. As it is sheared from the sheep, it contains dirt, salts from dried perspiration, and wool fat, a source of lanolin. Washing with warm soapsuds removes foreign matter. Wool is very sensitive to alkalies, but withstands dilute acids.

Crude silk consists of two types of proteins: fibroin and sericin (silk glue). As the liquid secreted by the silkworm is extruded in two very thin streams, the fibroin solidifies and is covered by the sericin; thus the two parallel fibroin filaments are joined. Much of the sericin is removed from raw silk by warm soapsuds before its manufacture into fabric. Silk absorbs considerable quantities of tin and iron salts, which give definite properties to fabrics.

Rayon is made from cellulose by converting it into a derivative which can be dissolved or dispersed in a liquid and extruded to form a continuous filament. Rayon first was made by converting cellulose to the nitrate by treating cotton linters with nitric and sulphuric acids. The thoroughly washed nitrate was dissolved in alcohol and ether and the liquid was extruded through very fine holes in platinum into the air. The filament was formed as the solvent evaporated. Treatment with sulphides removed the nitrate radicals so that the final product was chemically identical with the original cellulose. This process is obsolete.

Some rayon is made by dissolving cellulose in a solution of copper ammonia hydroxide, $\text{Cu}(\text{NH}_3)_4(\text{OH})_2$, and extruding the liquid into an alkaline bath. All copper and ammonia are removed.

Still larger amounts of rayon are made by the acetate process, which is rapidly increasing in importance. The cellulose is converted to the triacetate by acetic anhydride in acetic acid solution containing a little sulphuric acid. The triacetate is then partially hydrolyzed and the product is precipitated in water. An acetone solution of the acetate is extruded into warm air. The final product is still an acetate.

The larger part of all rayon is made by the viscose process. Cellulose in the form of cotton linters or wood pulp is treated with strong caustic soda, the excess of solution pressed out, and the alkali cellulose is dissolved and slightly oxidized. Carbon bisulphide reacts with this material and the xanthogenate is dissolved in dilute caustic soda. The solution attains the proper viscosity and most of the sulphur is removed. Spinning, as extrusion is often called, is into an acid bath. With removal of the last traces of sulphur, the product is a modified cellulose. Yearly production of rayon of all types averages 1.2 billion pounds.

The most recent types of textile fibers are essentially extruded and solidified molten plas-

tics. Nylon is a polyamide derivative made from dibasic acids and aliphatic amines containing two NH_2 groups. These combine to give products resembling proteins, since there is extensive polymerization to molecules of great size. After the polymer has been melted, it is formed into ribbons and then into chips. These are again melted and the liquid is extruded into the air. It solidifies as a tiny filament, which is later stretched, twisted, and made into yarn, thread, and fabrics. During World War II practically all nylon disappeared as a domestic textile because of military needs. Its uses included tire fabric, tow ropes, parachutes, shoestrings, and many other articles requiring an exceptionally strong, resilient, and resistant material. In peacetime nylon has returned largely to its dual purpose as a plastic and as a textile fiber. Its annual production is about 100 million pounds.

Leather.—Animal skins become very hard when dry and decompose if they are moist. Tanning involves the combination of skin proteins with substances which will form stable and flexible products. Hair and epidermis are loosened and removed by solutions of calcium hydroxide containing sulphides. Enzymes, such as pancreatin, eliminate small amounts of other undesirable proteins. Acids (both mineral and organic) remove residual lime and prepare the skin for tanning.

Vegetable tanning is by the action of complex phenolic glucosides from barks and woods. Skins are progressively moved into stronger tan liquors. Thick hides are packed with tanbark and soaked in tannin solutions. Basic chromium salts are the agents in the chrome tanning process. Combination with proteins resembles the combination of chromium salts with ammonia and involves a sharing of electrons. Other tanning agents are alum, formaldehyde, and cod liver oil. Sodium hexametaphosphate with other tanning agents gives a leather of remarkably fine properties. Leather absorbs oils and greases, is usually dyed, and is generally coated with water-repelling finishes.

Gelatin.—Collagen, a protein material, comes from treatment of skins and sinews with lime-water and from extraction of ground and degreased bones with dilute acids followed by neutralization with lime. Extraction of collagen with hot water produces a solution of gelatin. The finer grades of gelatin are foods, but the commercial variety is made into adhesives, sizes, and coatings for photographic plates and films. Glue, a term often applied to commercial gelatin, strictly refers to all types of adhesives.

Crudes and Intermediates.—A small number of aromatic compounds from light oils and tar of coal gas are known as crudes regardless of their purity. These include benzene, toluene, the xylenes, naphthalene, anthracene, phenol, the cresols, and carbazol. The first three, of which benzene is the most abundant, come primarily from light oils. Naphthalene represents about one tenth of the total weight of coke oven tar.

Although a much larger percentage of organic chemicals is made from petroleum than from coal byproducts, hundreds of different compounds are made from coal tar crudes. They are for the most part nitro, amino, and hydroxy derivatives of aromatic hydrocarbons. Some are employed directly as antioxidants, corrosion and gum inhibitors, vulcanization accelerators, insecticides, pharmaceuticals, and explosives. Many

others are the starting substances from which dyes, resins, and plastics are made. Hence they are called intermediates. Leading intermediates are nitrobenzene, aniline, phthalic anhydride, and betanaphthol. Phenol derived from coal tar is a crude, but if it is synthesized from benzene, it is an intermediate.

Synthetic Drugs.—Many but not all synthetic drugs are derived from coal byproducts. Some are identical with natural products, but many are new compounds. Classified on the basis of their physiological action, the main types are general and local anesthetics, narcotics, hypnotics, analgesics, and protozoacides. The discovery of the action of *p*-aminobenzene-sulfonamide in streptococcal infections was epoch-making. A number of these derivatives of sulfanilamide, all known as sulfa drugs (q.v.), have been prepared, each of which has a somewhat different field of usefulness.

Cessation of imports of quinine and other cinchona derivatives during World War II induced a great deal of research and development in the field of antimalarials. The chief antimalarial which was manufactured on a large scale and sent to personnel in subtropical and tropical climates was atabrine. As early as 1943, the production of this drug, amounting to 2.5 billion tablets, required 3 million pounds of intermediates and 25 million pounds of reagent chemicals.

Antibiotics.—The two leading antibiotics are penicillin salts and the streptomycins. Several other antibiotics, of which bacitracin, aureomycin, and chloromycetin are typical, have been developed. Of these only the last can be made synthetically as well as by fermentation. The biological unit by which antibiotics are measured is 0.6 microgram in the case of penicillin salts. In terms of pounds the annual production of penicillin salts and the streptomycins amounts to about 200,000 pounds of each.

Synthetic Dyes.—The first synthetic dye was made by Sir William H. Perkin (1838-1907) in an attempt to synthesize quinine. Later the constitution of alizarin (a plant product) was found and the same substance was synthesized. Once the structures of compounds characterized by intense color had been determined, the dye industry expanded rapidly. Thousands of new dyes have been synthesized. Dye formulas appear to be bewilderingly complex, but closer examination shows them to contain several relatively simple intermediates. The same chemical compound may have several different trade names.

Dyes are classified both by structure and by use. Some may be applied only to vegetable fibers and others only to animal fibers. Some dyes require preparation of the cloth with mordants (substances which adhere strongly to fibers and in turn absorb dyes). Some dyes are actually made on the fiber, one intermediate being applied and treated with another intermediate. After reduction of indigo (a typical vat dye) to soluble and colorless indigo white the solution is applied to fibers. Oxygen of the air converts indigo white to blue dye. Designs are printed from engraved rolls with the dye in a dextrin paste and also are woven with different colored threads.

Insecticides and Agricultural Chemicals.—An organic chemical known as dichlorodiphenyl-trichloroethane and discovered in 1874 was tested

in Switzerland as an insecticide in 1940. By 1949 it was made in the United States at the rate of 1,500 tons per month. Its tremendous potency against all sorts of insects was responsible for prevention of insect-borne epidemics during World War II and for saving of countless lives. This substance (commonly known as DDT) is employed both as a dust and as a spray; in the latter case it is dispersed by an inert and low-boiling liquid, such as the refrigerant freons (chlorofluoromethanes). Many other chemicals are employed as insect repellents, insecticides, fungicides, bactericides, weed killers, and growth stimulants. Two chemicals very effective in killing rats are sodium fluoroacetate and alpha-naphthyl thiourea. Both are toxic and dangerous to human beings and should be handled only by trained exterminators of pests.

Explosives.—Gunpowder (or black powder) is a mixture of potassium nitrate, charcoal, and sulphur. It is mainly a commercial explosive. The chief propellant is a cellulose nitrate product called smokeless powder. Cellulose nitrate containing 13 per cent or more of nitrogen is freed of water by pressing and by displacement with alcohol and is mixed with ether to a plastic mass. Diphenylamine in small amounts prevents decomposition initiated by traces of nitrogen oxides. Extrusion and cutting shape the powder grains. The smaller sizes have a central perforation, but the larger have seven symmetrically placed holes.

High explosives decompose rapidly and exert shattering action. They are of two types. Dynamites have as their main explosive ingredient glyceryl trinitrate (incorrectly called nitroglycerin) together with sodium and ammonium nitrates and combustible material. The second type is represented by nitroaromatic compounds such as trinitrotoluene (TNT) and picric acid (or trinitrophenol). TNT is generally mixed with 50 to 80 per cent of ammonium nitrate. A very safe explosive, set off only by TNT or dynamite, contains 92 per cent of ammonium nitrate.

Explosions are initiated either by flame from a cap or fuse or by detonation of a small amount of a sensitive and very powerful explosive such as mercury fulminate or lead azide. See also EXPLOSIVES.

The effects of ordinary explosives have been dwarfed in comparison with the effects of relatively small amounts of such fissionable elements as uranium 235 and plutonium. The production of these elements was a joint effort of physicists, chemists, and engineers. See also ATOMIC ENERGY; NUCLEAR ENGINEERING.

Synthetic Resins and Plastics.—The term resin is applied to a number of natural and synthetic products which possess noncrystalline structure, luster, insolubility in water, and hardness. The term plastics conveys the idea of soft and easily shaped and molded articles which harden to the consistency of a resin. True thermoplastics are soft when warm and harden when cooled. Thermosetting plastics are at first soft when hot, but undergo chemical changes, harden while hot, and remain hard and infusible at temperatures short of burning.

Synthetic resins and plastics have been classified as follows: thermosetting resins, thermoplastic resins, oil-soluble or modified resins, and protein plastics. Thermosetting materials include phenolic resins, aminoaldehyde or urea formaldehyde resins and glycerin-phthalate

(alkyd) resins. Dr. Leo H. Baekeland (1863–) made the first successful phenolformaldehyde resin before 1910. Thermoplastic resins are represented by cellulose derivatives (mainly esters and ethers), of which cellulose nitrate, cellulose acetate, and ethyl cellulose are the most important, and by a variety of polymer resins derived from acrylic esters, polyvinyl and polyvinylidene derivatives, coumarone and indene polymers, styrene and polyamides. Nylon, as indicated earlier, is a polyamide derivative and, while it is used primarily in filament form, is also a valuable thermoplastic. Modified rosins are also important plastics. The oil-soluble resins used largely in paints are for the most part modified alkyd and phenolic resins and pine rosin, which has been esterified with glycerin. Proteins from such sources as milk, corn, and soya bean are a promising, but still small, base of plastics. The proteins are hardened by formaldehyde.

Petroleum is the source of an increasing number of resins, originally developed for military purposes but later available for general use. They vary from hard and brittle materials to products with some of the properties of rubber. All are thermoplastic with high flash and fire points and find use as laminants, adhesives, binders, plasticizers, and ingredients of coatings of various types.

Fluorine is responsible for a new and remarkably resistant plastic, polymerized tetrafluoroethylene, which has the trade name teflon. This substance is probably the nearest approach of any carbon compound to the chemical resistivity of gold and platinum. It resists such potent chemicals as aqua regia, sulphuric acid, and concentrated alkali solutions, and is only attacked by molten alkalies. Long exposures to temperatures as high as 300°C. do not damage this plastic solid, which is flexible at -75°C. Its chief use is in resisting heat and solvents and in all types of electrical equipment.

Paints, Varnishes, and Lacquers.—Most of the ingredients of paints and varnishes have been mentioned, including pigments, oils, turpentine, petroleum distillates, synthetic and natural resins, and cellulose esters. Paints are suspensions of pigments in a mixture of oils and volatile solvents. The liquids are vehicles and the volatile materials are solvents or thinners. Small amounts of lead, manganese, cobalt, and iron compounds are driers, increasing the rate of reaction of oxygen with oils to form hardened films. Solvents permit smooth application. Some resins may be included for gloss finishes.

Varnishes are mainly solutions of oils, driers, and resins in solvents. Less important are solutions of shellac in alcohol. Rosin and damar come from living trees. Shellac is produced by insects from the sap of trees in India. Copals, products of prehistoric trees, are fossil resins. Synthetic resins are oil-soluble products of the phenol-formaldehyde or glycerin-phthalic acid types and rosin-glycerin ethers.

Cellulose nitrate and acetate are the main ingredients of lacquers. Pigments, resins, high-boiling plasticizing liquids, solvents for cellulose esters, and thinners are the other components of these protective coatings. See also LACQUERS, INDUSTRIAL; PAINT; VARNISH.

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W. T. READ,
Research and Development Division, General
Staff, Department of the Army.

CHEMICAL MINERALOGY. See MINERALOGY.

CHEMICAL SENSE. In physiology, a nervous mechanism or function for reception of, and response to, chemical stimulation. Specifically, chemical sense refers to the nervous process initiated by excitation of special receptors sensitive to chemical substances in solution. One kind of chemical sense appearing universally in the case of body surfaces bathed with solutions of irritants, and, in vertebrates involving spinal, as well as cranial nerves is called *common chemical sense* and is distinguished from the *special* chemical senses, as taste and smell recognizable in man and the higher animals. See also ANIMALS, CHEMICAL SENSE IN.

CHEMICAL SYMBOLS, letters or symbols used in chemistry to designate the various chemical elements. They are merely the first letters of the names of these elements (not in every case of their English name); or when the names of two or more elements begin with the same letter, two letters are used as the symbol, one of which is always the first letter of the name of the element. Generally speaking the letters comprising the symbol are taken from the English name of the element; but in some instances, especially in the cases of metals which have been long known, the symbols are derived from the Latin names: thus we have *Hg*, symbol for mercury, from the Latin *Hydrargyrum*; *Fe*, from the Latin *Ferrum*, for iron; and so on. In a few cases the symbols are deduced from the old German names: thus *K*, the symbol for potassium, is the first letter of the old German word *Kalium*, and *Na*, the symbol for sodium, is from the German *Natrium*. However derived, whether from English, German, Latin or French, the symbols of the chemical elements are universally the same. For a considerable time French chemists employed the symbol *Az* to represent nitrogen, from the name *Azote*, which was given to this element in reference to the fact that it alone could not support life (Greek, *a*, privative, and *zōē*, life); but this symbol is now almost entirely superseded by the letter *N*. The symbols of chemical compounds are constructed by placing together the symbols of their constituent elements, a number being attached to each signifying how many atoms of the element enter into the composition of the amount of the compound expressed by the entire symbol. For it must be understood that chemical symbols have a quantitative as well as a qualitative meaning. When a chemist meets in a chemical treatise with the symbol *O* he knows that this signifies not only oxygen but a certain definite amount by weight of oxygen, *O* always means 16 parts by weight of oxygen, so *Fe* means 56 parts by weight of iron; and so also the compound symbol *Fe₂O₃* means $(56 \times 2) + (16 \times 3) = 160$ parts by weight of oxide of iron. For a further account of the uses and modes of formation of chemical symbols see the article CHEMISTRY.

CHEMICAL WARFARE, a term used to indicate the organized use of chemical materials, rather than explosives, as auxiliary aids for the injury of personnel and materiel of an enemy, by destroying structures and rendering uninhabitable certain areas, all with the view of dispersing and conquering his forces. For practical purposes the agents used in chemical warfare may be classed as: (1) incendiaries; (2) poison gases; (3) smoke. The weapons by which these agents are brought to bear upon the enemy are known as *chemical weapons*. The vehicles containing the material, such as shells, grenades, etc., are included in the term munitions. Aids not strictly chemical but more or less in the same category and used for the same purpose, are those which utilize bacteria that are known to produce disease, to start epidemics among people, animals, and crops. This method of warfare is known as biological warfare. The materials used for carrying on warfare as just described and of providing the means of protection against it, are functions of the Chemical Corps of the United States Armed Forces.

Historical Background.—Among the earliest of chemical weapons used in war is fire, it having survived to the present day. Suffocating gases were in use during military operations of the Peloponnesian War between the Athenians and the Spartans in 431–404 B.C. Thucydides, the historian, has related that large masses of pitch and sulphur were ignited and used during two sieges of the war. The so-called Greek fire was probably composed of powdered resin or bitumen, sulphur, naphtha, and perhaps niter. This material was poured upon dry wood and was extremely effective. There are records that it was used in 673 A.D. during the defense of the Greeks against Saracen hordes. The liquid was poured from ladles, while still burning, or was shot from tubes or from ballistae in the form of flaming arrows carrying tow soaked in the mixture. Greek fire is said to have been used in the Middle Ages, the incendiary being pumped through pipes and sprayed upon the enemy. This device was the forerunner of the modern flame thrower. In more recent times the American Indians used incendiary arrows to fire forts and stockades during the early days of white settlements. In the Crimean War (1855–1857) the British forces engaged proposed to reduce the fortress of Sebastopol by incendiary and gas attacks but the British government declined to permit it. In 1863, during the American Civil War, at the siege of Charleston, shells containing sulphur, niter, naphtha, and lampblack were used with little or no effect on the garrison. In 1871, during the Paris Commune petroleum bomb shells are said to have been fired. The subject of chemical warfare was introduced for discussion at the Hague Conference of 1899. Again in 1907, at the Hague Peace Conference a resolution was passed expressly forbidding the use of poison or poisonous weapons. In 1922, at the Washington Peace Conference, a treaty was signed abolishing the use of poison gas. The use of toxic gases began on April 22, 1915, when chlorine was released by the Germans against the British in the Ypres area and a new weapon was forged which required new tactics of offense and defense among the armies of the world. It should be noted that however barbarous the use of poison gas, it still remains a military weapon, while the poisoning of drinking water in wells or springs has always been regarded as against the

laws and customs of war and as subjecting offenders, if apprehended, to summary trial on the spot.

Incendiaries.—The development of fire-resistant structures, long range artillery, and mobile warfare made the use of incendiaries almost obsolete until the era of the airplane. This event abolished almost at once all ordinary means of protection of the civil inhabitants of a country so that they shared the dangers of a war equally with the military forces. There are several types of incendiaries, varying considerably in weight and in construction. The most common agents are: thermit, magnesium, incendiary mixture, incendiary oil, and napalm.

Thermit incendiaries are usually small, weighing a few pounds only, and are discharged as bombs or as grenades. This bomb will remain active longer than most others of equal weight. It produces a heat sufficient to ignite and consume the casing. During the initial stage, molten incendiary metal is sprayed about over an area with a radius of 50 feet. The bomb will burn for about 10 minutes. Its use is tactical and not directed against personnel although it may cause severe burns. It is especially useful in penetrating any ordinary roofing such as slate or tile, causing serious fires in upper stories. In World War II, in some areas 15 per cent of bombs dropped scored hits on buildings, about one half of these starting fires.

Magnesium bombs are also used as incendiaries and only for tactical reasons. This bomb will cause severe burns if in contact with persons.

Incendiary mixture has a composition that is not disclosed and is used in bombs only. It produces bad burns. **Incendiary oil** is a petroleum bomb which is employed to spread inflammable liquid over a large area near fires already started, in preparation for an attack by thermit bombs. These bombs do not ordinarily carry their own combustible agents. Such bombs may be used to drench the clothing of fire fighters thus incapacitating them from dousing fires. Cardboard disks impregnated with phosphorus were used in World War I by the Germans to start fires in standing crops or farms but are not standard equipment today.

Napalm is a material used to thicken gasoline or use in flame throwers and incendiary bombs. This type of incendiary is very effective when dropped from planes or thrown from tanks. It starts fierce and devastating fires that destroy everything in its path. Although used as a tactical weapon it is greatly destructive to human life when no protection is afforded. The most satisfactory method of fighting a thermit bomb is to control its burning, hasten its destruction, and prevent the fire from spreading. During the initial period of violent sputtering no attack should be made upon the bomb itself and efforts should be directed toward keeping the surrounding area thoroughly saturated with water. After the initial period of several minutes, water may be sprayed directly on the bomb at close quarters. Water increases the activity of the bomb and causes it to burn out more quickly. For the purpose of control a hand stirrup pump was used effectively by the British during World War II. The type most favored was one equipped with 30 feet of hose which conducted a jet of water. The chief advantages of the hand pump are its portability and its easy access to buckets and tanks of water independent of the regular water supply. Another method of dealing with the thermit bomb is to

cover it with sand, making no attempt to accelerate the burning and keeping it merely under close observation. This method is applicable to those cases in which no extensive fire has been started. The only chemical extinguishers that can be used safely are those of the soda-acid type. Carbon tetrachloride is dangerous because if it comes in contact with burning magnesium, phosgene gas will be generated.

Chemical Weapons, Agents, and Munitions.

—An important chemical weapon is the flame thrower. This is an apparatus made in varying sizes and having various ranges. It is equipped with a head carrying a pilot light. The device is highly efficient against intrenchments, pill-boxes, etc. It projects or sprays a flammable liquid consisting of water, gas, tar, and benzene. The liquid is only partially consumed when it strikes, a distinct advantage, since it is desirable to saturate the object with burning liquid rather than to burn it with a momentary flame. A portable flame thrower weighs about 70 pounds and can be carried on the back of one man. It has a sustained rate of about 10 seconds and a range of 40 yards. The mechanized flame thrower weighs several hundred pounds and is mounted on a medium tank. It has a range exceeding 140 yards. A recent development (1952) is a giant flame thrower that is a major advance in engineering. It is built into the M-47 tank and constitutes the main armament. The large cannon carried by the tank has been removed to make room for the flame thrower which itself weighs 50 tons, or more than the weight of the tank on which it is mounted. A tremendous pressure has been built up in the flame thrower so that napalm can be ejected at high speed and at a long range. This is accomplished by the use of a special compressor. The range is said to be several times as great as in any other type. Other chemical weapons used to discharge or burn chemical agents are mortars of different sizes and ranges carrying high explosive shells.

The term *chemical agent* applies to gases of different types and purpose, incendiaries, and screening smokes. The use of atomic weapons is not considered here. *Chemical munitions* are vehicles for projecting, evaporating, or burning the agents just referred to. Under this head are: candles, grenades producing tear gas, colored smoke, etc., and thrown from the hand; rifle grenades of the same character; rockets; smoke pots; shells containing chemicals and gases. Grenades weigh from one to ten pounds. Tear gas released from a grenade burns from one to two minutes. A tear gas candle will burn from three to five minutes. Incendiary containers are marked with a purple band.

War Gases.—These chemical agents fall into two main classes: (1) casualty gases; (2) harassing gases. By *casualty gases* is meant those that inflict severe injury on personnel, even death, in those unprotected or only partially protected. Gases of the first category are further divided into:

(a) Blister gases (vesicants) and choking gases (lung irritants); and (b) nerve gases. (a) The blister gases are mustard gas, distilled mustard, nitrogen mustard, and lewisite. All containers holding these gases are marked with a green band. All gases of this category injure the eyes and lungs and blister the skin, causing deep burns that heal with difficulty. Against unprotected clothing they penetrate to the skin. The effect on

the respiratory apparatus is severe since serous fluid accumulates in the lungs, greatly hindering the respiration. Most blister gases persist for several days in summer and several weeks in winter, remaining active in hollows and woods. They are also referred to as persistent gases. They are generally released as liquids which evaporate slowly. The liquid is dangerous to touch and vapor liberated will immediately contaminate the surrounding area. An area exposed will remain contaminated until complete evaporation occurs, or the gas has been neutralized. Choking gases, such as chlorine and phosgene have little persistence, not more than a few minutes in summer and perhaps 20 minutes in winter. Weather conditions influence the effectiveness of gas. Wind carries it along and volatilizes the liquid more rapidly than is the case in calm weather, but high winds interfere with concentration of gas. In very cold weather liquid gas may freeze. This will prevent gas vapor from forming but the solid released will still inflict severe skin burns. Heavy rain will dissipate gas on the ground but light rain has little effect. Built-in areas that have been gassed are dangerous because the gas remains in high concentration much longer than in open country. (b) Nerve gases. These are blood and nerve poisons perfected especially since 1941. At least three of these casualty agents are available in munitions marked with a green band. They are: cyanogen chloride; hydrocyanic acid gas; arsine. All are lethal agents. Their persistence is limited to about ten minutes except in the case of hydrocyanic acid which may persist for several hours. These nerve gases are highly toxic, having an action like, but more prolonged than, physostigmine. They are readily absorbed by the respiratory tract, skin, eyes, and gastrointestinal tract. The symptoms begin early and progress rapidly, the action of the poison being much the same as nerve insecticides such as parathion and tetraethyl pyrophosphate. Acute poisoning is manifested by excessive stimulation of the parasympathetic system, the central nervous system, and the entire motor nervous system. The group of symptoms resembles muscarine and nicotine poisoning. Loss of appetite, nausea, vomiting, abdominal cramps, and diarrhea are generally present. In addition there occur increase in sweating, lacrimation, a sense of tightness in the chest, and difficult or spasmodic respiration. Patients complain of intense fatigue, muscular weakness, and insomnia. In some cases an intense mental depression is observed. If poisoning is the result of a large dose of nerve gas, the pulse becomes weak or imperceptible, succeeded by convulsions, cyanosis, and involuntary urination and defecation. There is thought to be a narrow margin between the dose that produces moderate toxic symptoms and one that will prove fatal. Repeated exposure to the gas shows that its effects are cumulative. The manner in which detoxification occurs and how excretion of the agents takes place is not known definitely. In large doses all those not protected become casualties, with development of alarming symptoms. Little ventilation of the lungs will be possible on account of the spasmodic closure of the air passages. The number of respirations gradually diminishes and the heart action becomes weaker and weaker. If the effects are not lethal, complete respiratory paralysis does not take place and the subject recovers slowly although the symptoms mentioned persist for some days with

perhaps evidence of some mental derangement. The diagnosis of nerve-gas poisoning is to be made from the characteristic symptoms. The treatment of this type of poisoning is both preventive and active. Casualties from exposure to the gas endanger unprotected personnel, hence handlers should wear rubber aprons and gloves. The free use of water is important to remove agents remaining on clothing or equipment. A gas mask is essential to protect from either vapor or spray. Ordinary clothing gives little protection. Nerve gas can poison both food and water, an important fact to remember. First aid treatment can be divided into life-saving measures and those undertaken for the relief of symptoms. The use of atropine to relieve intermittent bronchospasm, cyanosis, slowed pulse, and depressed blood pressure is advised, about two milligrams being given intravenously every two or three minutes until symptoms are relieved or dryness of the mouth occurs. Some cases tolerate unbelievably large doses without evidence of atropine poisoning. Barbiturates may be given to control convulsions.

Harassing gases.—These are agents which produce incapacity for military action in those who come in contact with them. They are not classed as casualty gases and are best adapted for use in limited areas and in closed spaces, for handling unruly prisoners, subduing riots, disarming small groups, etc. The gases are subdivided into vomiting gases (emutators), and tear gases (lacrimators). These gases produce temporary disability up to 24 hours. Those exposed to vomiting-gas show symptoms of headache, nausea, vomiting, and mental depression. *Adamsite* is odorless or with an odor somewhat like coal smoke and acts within a few minutes. Diphenylchloroarsine has a similar action and odor but produces much more active vomiting. The most effective tear gas is chloracetophenone, a white solid with an odor of apple blossoms. It is used in grenades or pots. Its solution has a sweetish odor of benzene. These gases cause an intense and blinding flow of tears and act within 10 minutes (see table). The gas also irritates the skin but has no permanent effects.

All gases are most efficient when used against unprotected troops and are extremely effective in surprise attacks especially if masks are not available. The effects on civilians in large communities will almost certainly be serious both in casualties and in loss of morale. Detection of gas may be based on odor, immediate visible effects, especially those of irritation, visible signs of injury, and chemical indicators. Proper defense against gas requires thorough training and drill in the use of protective equipment and the understanding of warning alarms. Respirators or masks are of various types. In World War II the British used the following: (1) civilian respirators including those designed for babies and small children; (2) civilian duty respirators for those working in gas-contaminated areas; (3) service respirators issued to the armed forces. All respirators consist of a rubber face-piece covering eyes, nose, and mouth and held in place by a head harness. To this is attached a canister to absorb gases and poisonous smoke. The canister-type is quite generally standardized for present use. The canister contains activated charcoal and lime-soda to absorb gases, and a filter pad for removing solid particles emanating from harassing gases and smoke.

Smoke.—A smoke screen is a device for ob-

TABLE OF WAR GASES

Type	Properties	Odor	Physical Effects	Persistence	Function	Method of Use
Casualty Gases						
Mustard distilled (dichlorodithiylsulphide)	Oily liquid; colorless, volatile.	Garlic or horse-radish.	Injures eyes and lungs; blisters the skin.	3-4 days to 3-4 weeks.	Casualty.	Bomb, artillery, mine, spray.
Mustard	Oily liquid.	Same as above.	Same as above.	3-4 days to 3-4 weeks.	Casualty.	Same as above.
Nitrogen mustard	Same as above.	None or a faint fishy.	Same as above.	3-4 days to 3-4 weeks.	Casualty.	Artillery, mine, spray.
Lewisite (Chlorovinylchloroarsine)	Oily, colorless liquid and gas.	Geranium.	Same as above.	1 day = 1 week.	Casualty.	Same as above.
Choking Gases (lung irritants)						
Phosgene (carbonyl chloride)	Nearly colorless gas.	Musty hay.	Injury to lungs with accumulation of fluid.	5-20 minutes.	Casualty.	Bomb, mortar, rocket.
Blood, Nerve Poisons (paralysants)						
Cyanogen chloride	Colorless gas.	Bitter, irritating.	Injures lungs; causes paralysis.	1-10 minutes.	Casualty.	Bomb, mortar, rocket grenade.
Hydrocyanic acid	Same as above.	Bitter almonds.	Dizziness; paralysis; coma.	1 minute to several hours.	Casualty.	Same as above.
Arsine (hydrogen arsenide)	Same as above.	None or garlicky.	Slows respiration; headache, nausea; anemia, jaundice.	1-10 minutes.	Casualty.	Same as above.
Harassing Gases (sternutators; lacrimators)						
Adamsite (diphenylaminechloroarsine)	Gas or solid.	None or a coal smoke.	Headache, nausea; sneezing.	1-10 minutes.	Vomiting gas.	Candle, grenade.
Diphenylchloroarsine	Colorless solid.	Same as above.	Same as above.	1-10 minutes.	Same as above.	Same as above.
Chloracetophenone	White solid.	Apple blossom odor.	Causes crying; irritates skin.	1-10 minutes.	Tear gas.	Grenade; pot.
Tear gas solution (1) (chloracetophenone) solution	Colorless solution.	Sweetish; benzene odor.	Same as above.	1-50 minutes.	Same as above.	Bomb; mortar.
Tear gas solution (2) (chloracetophenone) solution	Same as above.	Same as above.	Same as above.	1-50 minutes.	Same as above.	Bomb; mortar; spray.

scuring the movements of combatants in warfare. In World War I smoke screens were laid on land by smoke shells or bombs containing phosphorus. Such screens can also be laid by planes flying low or on the water by navy destroyers. Destroyers are equipped with special burners for phosphorus or other chemicals such as chlorosulfonic acid. Both Zeebrugge and Ostend harbors were screened by British forces at the time they were blocked. In ancient times the use of smoke was probably directed more toward its asphyxiating action than to its value as a screen. However, in former days both smoke and fog have decided the issue of many a battle. The invention of smokeless powder came about as a result of the obscurity developing in battles of the Civil War, when only black powder was in use. The use of smoke may be offensive or defensive. When used as a screen it is generally produced by smoke candles, generating tanks, airplanes, and destroyers. As a confusing blanket it is laid by shells and bombs and denies the enemy information, reduces the effects of hostile fire, hampers hostile attacks, and may effect surprise. It may be used for local covering of small areas such as roads and bridges. Smoke is made up of solid or liquid particles and its effectiveness depends upon their size, concentration, color, and persistence. There are many screening smokes listed in the armamentaria of armed forces. Among these are: phosphorus, plasticized white phosphorus, sulphur trioxide, chlorosulfonic acid, titanium tetrachloride, and

hexachlorethane. The first two have an odor of burning matches and, while not poisonous, the solid particles burn the skin. These smokes are released by bombs, artillery, mortars, grenades, and rockets. The smoke persists until the source is consumed. The other agents mentioned have an acrid odor but are not harmful. Fog oil has an odor of oil and is discharged from a mechanical smoke generator. It has no ill effects. Phosphorus smoke shells for use in howitzers and mortars are calculated in rounds per minute per 100 yards of coverage, indicated by quarters of the clock. The smoke produced has both screening and casualty value. Smoke containers for military use are marked with yellow bands. In general, white or light colored smokes are more effective than dark colored or black smoke due to the higher degree of reflection in the former.

Biological Warfare.—This may be defined as the intentional use of living disease agents or their toxic products for the purpose of causing death in man, animals, or crops. It is an attempt to use the forces of nature in war and is directed essentially against persons and especially their food supply. This form of warfare, so naturally abhorrent to the minds of civilized nations, recognizes the possibility of man's using pathogenic organisms as agents in the furtherance of his grim purpose. Three types of agents are at hand, the antihuman, and antianimal, and the anticrop. Of the agents directed toward human beings, it is logical to consider the possibilities existing in

bacteria, viruses, and rickettsia, and perhaps in fungi. Many of these are airborne and are capable of initiating epidemics. Theoretically such agents could be disseminated far and wide by means of aircraft and dispersed in the form of infective clouds which would be colorless, tasteless, and invisible. A second method involves the clandestine introduction of these agents to cause contamination and spoilage of food, air, and water. Such attempts might well fail if attacks were made on well chlorinated water supplies or if foods contaminated were afterward well cooked. While it should never be forgotten that biological warfare could be utilized by enemy forces or by an enemy underground (secret agents, sabotage) it should also be realized that it is no secret super-weapon. While the term "germ warfare" is in a measure explanatory of the character of biological warfare, it is not all-inclusive and the latter term, often shortened to BW, is better. It can be divided into three parts: (1) attacks by living agents such as bacteria and viruses; (2) attacks by toxins and poisons produced by bacterial action; (3) attacks by chemicals known as artificial hormones or growth regulators, such as those used to kill weeds. It should be repeated that biological warfare signifies the *intent* to use these means and to spread epidemics to kill or disable populations. It should never be applied to epidemics occurring as a result of lack of proper sanitary and hygienic measures being taken in the presence of epidemic disease. Except on a limited scale biological warfare has not been used by any of the powers in war and it is to be doubted if this type of warfare could ever decide the issue of a war. Certainly no modern city or municipality could be destroyed by such means. So far as is known there are no mystery germs that could cause a devastating epidemic. In the present state of biological warfare it is well recognized that defensive measures such as regard for public health precautions are important elements in the protection of all communities of the civil population.

See also ARSENIC; BOMB; FLAME THROWER; GAS POISONING; LIQUEFIED AND COMPRESSED GASES; POISON GAS.

Recommended Reading.—ATOMIC WARFARE: U.S. Dept. of the Army pamphlets 20-110, 20-111, 20-112, available through Superintendent of Documents, United States Government Printing Office (Washington, D.C.).

BIOLOGICAL WARFARE: Rosenberg, Kobat, and Boldt, "Bacterial Warfare" in *Journal of Immunology*, vol. 56, No. 1, 1947; Philbrook, F. R., "Biological Warfare," *Medical News Letter*, published by Chemical Corps School, Fort McClellan, Ala. (Jan. 1951); Department of the Army pamphlet No. 8-12 available through Superintendent of Documents, U.S. Government Printing Office (Washington, D.C.); *What You Should Know About Biological Warfare*, pamphlet issued by Federal Civil Defense Administration, available through U.S. Government Printing Office (Washington, D.C.).

CHEMICAL WARFARE: "Air Raid Precautions" issued by H. M. Stationery Office, available through Chemical Publishing Company (New York 1941); Galdston, Morton, Leutscher, John A., Longcope, Warfield T., and others, "A Study of Residual Effects of Phosgene Poisoning in Human Subjects," *Journal of Chemical Investigation*, vol. 27, No. 2 (March 1947); Wood, John R., "Address" (gas

CHEMISTRY. Chemistry is a science which deals with the composition, properties, and changes of substances. The ancients possessed considerable factual knowledge of chemical changes brought about in such industries as the winning of metals from their ores, the extraction of dyestuffs from plants and their application to fabrics, the tanning of leather, and the production of glass and pottery, but this information was handed down by generations of craftsmen without either organization or a background of theories and principles.

Egypt was the home of arts involving chemical changes. Its black soil gave it the name of Khem, which became attached to those phenomena and their utilization that are now associated with the science of chemistry.

The contributions of the Greeks were largely confined to thoughts without any amount of experimental evidence. The elements of the Greeks, fire, water, earth, and air, were merely properties of matter.

In the Middle Ages the progress of chemistry owed its small advancement to the practice of alchemy, which had as an objective the transformation of base metals into gold. It has been pointed out by Dr. F. J. Moore in his *History of Chemistry* that the alchemists had logic on their side, since they had seen chemical changes and reasoned that if some substances could change, it should ultimately be possible to convert one metal into another more valuable metal. There was also a great deal of the mysticism of secret and religious orders about the practice of alchemy.

The interest in the search for the gold-transforming philosopher's stone and for the elixir of life shifted in the 15th century to the applications of chemicals in medicine. Georg Agricola (q.v.), a physician who became a metallurgist, was a notable exception in his age.

Robert Boyle, best known for his researches with gases, in 1661 defined an element as a form of matter that had not been decomposed. It was about this time that Georg Ernst Stahl proposed the "phlogiston theory" which explained such reactions as burning or rusting as the loss or gain of a mysterious invisible substance called phlogiston. Mikhail V. Lomonosov, the great 18th century Russian scientist, had ideas about atoms, molecules, and the conservation of matter that placed him a hundred years ahead of his time. The investigations of Henry Cavendish, Karl W. Scheele, and Joseph Priestley regarding hydrogen, chlorine, and oxygen were milestones in the progress of science. Antoine Laurent Lavoisier, who died under the guillotine in 1793, was the greatest figure in the history of chemistry in the 18th century's closing years. His insistence upon weighing and measuring banished the phlogiston theory and vindicated the idea of the indestructibility of matter.

With the beginning of the 19th century, the modern science of chemistry entered a period of growth and development that has continued with increasing vigor to the present day.

Properties of Substances.—In defining chemistry, the terms *substance* and *property* have been used. In the strict scientific sense a substance is more than a form of matter, and has been aptly defined as "a definite variety of matter, all specimens of which show the same properties." Color, taste, and odor are properties of substances. Determinations of the

"Medical Problems in Chemical Warfare," *Journal, American Medical Association*, vol. 144, pp. 606-609, April 21, 1950; "Chemical Warfare" issued by Armed Forces Chemical Journal, April 1952.

HAROLD WELLINGTON JONES, M.D.,
Colonel, Medical Corps, United States Army
(Retired); Editor of "Blakiston's New Gould
Medical Dictionary."

odors of some substances and the taste of many more are undertaken with considerable caution because of their possible poisonous character. The weight of a given volume under given conditions, otherwise called *density* or *specific gravity*, is a property of every substance. Water is the common standard of comparison of solids and liquids, while gases are generally compared with hydrogen or with air. The temperatures at which a solid melts and a liquid boils under a given pressure are physical constants that are also properties of these substances.

It is scientifically incorrect to speak of an "impure substance," and both incorrect and tautological to refer to a "pure substance." In the first instance the reference is to a mixture of two or more substances. Substance means only one form of matter, and "pure" is unnecessary.

States of Matter.—Before considering chemistry further, a review of some elementary physics will be helpful. Substances and mixtures of substances, or matter in general, exist in the three states, *solid*, *liquid*, and *gaseous*. The same substance may be in any one of the three states, depending on conditions.

What is commonly thought of as a solid is a form of matter that is sufficiently hard and rigid to retain its shape independent of its surroundings. If no other force than that of gravity is brought to bear on a solid, it shows no tendency to change its dimensions. True solids are crystals that have a definite internal and external pattern, but this distinction need not be made as yet.

A liquid does not change its volume, but it takes the shape of its container. Liquids flow more or less readily, and many of them change rapidly into gases with moderate increases in their temperatures.

Gases fill any container in which they are placed, being readily compressed to smaller volumes, and expanding when pressures are lowered.

Gases at ordinary pressures are regarded as being made up of infinitely small particles called molecules. At the temperatures to which we are accustomed, these molecules are in rapid and continual motion, colliding with the walls of the container and with each other. The temperature of a gas is a measure of the intensity of the motion of its molecules. Pressure of a gas is exerted by the continued bombardment of its molecules against retaining surfaces. The space occupied by gaseous molecules and the attractions between molecules may be neglected as long as only the gaseous state is considered and pressures are not high.

In the liquid state, the molecules are still in motion, but they are so close together that attractive forces prevent the distances between them from becoming appreciable. The molecules slide freely past each other, and thus the liquid flows and there is constant mixing of molecules.

There is motion in the solid state at ordinary temperatures, but this motion is a vibration so that individual molecules do not greatly change their relative positions to each other. In fact, as will be explained later, the distinction of individual molecules is more or less lost, and still smaller units are dealt with, which necessitate chemical rather than purely physical ideas.

The point at which all motion ceases is the *absolute zero*, which is 273 C. (460 F.) degrees

below the melting point of ice at atmospheric pressure (0° C. or 32° F.). At any temperature above absolute zero, there is some sort of motion of molecules or smaller units.

Molecules escape from the surface of a liquid, and in a closed container partially filled with liquid, the rate of escape is quickly equaled by the rate of return of the gaseous or vapor molecules to the liquid state. The higher the temperature, the more rapid is the rate of escape and of return, and the higher the pressure exerted by the molecules of the vapor. There is a similar escape and return from the surface of a solid, although for many solids the tendency is not measurably great.

When heat is applied to a solid, the vibrations of its particles increase in intensity, and at a certain point molecules escape from the surface to form a liquid. At this point the temperature does not rise further until all the solid disappears. Before this happens, if no heat is applied and its escape is prevented by insulation, there will be an equality in the number of molecules escaping or returning to the solid state, or what is known as an equilibrium.

A solution refers to a mixture of molecules of two or more substances. Ions, which are charged particles, made up of one or more atoms function like molecules in solution. Gases mix in all proportions and there are solid solutions, but the term *solution* is generally thought of as a mixture of molecules in the liquid state. Some liquids mix in all proportions, but there is usually a definite limit of the solubility of one substance in another. Solubility changes with temperature, but whether it decreases or increases depends on the nature of the substances involved.

When a membrane is interposed between a liquid that is a single substance and a solution of one substance in another, it often happens that one kind of molecule will pass through the membrane and another kind will not. For example, a solution of sugar in water divided by a membrane from water will lose water molecules from the solution. A definite pressure on the water side is required to cause the water molecules to pass at equal rates through the membrane. This *osmotic* pressure has the quantitative aspects of gas pressures. (See also **MATTER**.)

Characteristics of Chemistry.—Chemistry is primarily the science of the transformations of substances into other substances. Two or more substances may combine to form a new substance; a substance may decompose into other substances; and other changes may take place that seem more impossible and unexplainable. Iron and sulphur are substances with very marked and unmistakable properties. One is dense, gray, and insoluble, and is attracted by a magnet. The other is much less dense, is yellow, is soluble in certain solvents, and is not affected by a magnet. The two substances can be ground and mixed and then separated, either by dissolving the sulphur in carbon bisulphide or by drawing out the iron by a magnet. If the mixture is heated, it will remain hot for some time after the source of heat is withdrawn, and the product has none of the properties of iron or sulphur, but a new set of properties of its own. A red solid known as mercuric oxide is converted by heating into liquid mercury and gaseous oxygen. Metallic zinc dissolves and

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disappears in a solution of sulphuric acid in water; gaseous hydrogen escapes; and removal of the water leaves a white solid called zinc sulphate. In this case two substances are converted into two other substances. These are chemical transformations. The melting of iron and its crystallization from the liquid state; the dissolving of sulphur in carbon bisulphide; the passing of an electric current in a coil around a mass of iron to render it magnetic, all are thought of as physical changes. Only when new substances are formed is the field of chemistry really entered. However, there are so many close interrelations among the sciences that it is often very hard to draw sharp distinctions.

A second striking characteristic of all chemical changes is that definite quantities are always involved. Chemical reactions take place according to fixed proportions by weight, and in the case of gases, according to simple volume ratios. For example, slightly more than 2 grams of hydrogen will combine with 16 grams of oxygen to form approximately 18 grams of water. At the same time the volume of hydrogen that combines is just twice that of oxygen. If the two substances were present in different proportions from these, some of one or the other would remain uncombined. The quantities involved have been determined with the utmost care, and the same results have been obtained a great many times, so that the law of definite proportions has been thoroughly established. This law in turn depends on the law of conservation of mass, which is that in any isolated system, or portion of the universe set aside for observation, there is neither gain nor loss of matter. This also applies to energy. A small loss in weight has been observed in connection with atomic fissions and the formation of radioactive elements. This loss in weight is accompanied by evolution of enormous quantities of energy. Instead of considering the two, mass and energy, separately, modern science puts them together in the law of the conservation of mass-energy.

A third characteristic of chemical change is that definite quantities of energy are involved. Heat energy and electrical energy are the two types that are more commonly associated with chemical reactions, although other forms such as light energy or mechanical energy also accompany chemical changes. For example, 12 grams of carbon (graphite) combine with 32 grams of oxygen to form 44 grams of carbon dioxide with the evolution of 94,030 calories of heat.

Elements.—Certain substances cannot be decomposed by any ordinary chemical methods into other and simpler substances, nor can they be made by the combination of other substances. This generalization still holds in the common experience of chemists, and any modifications of this statement will be better understood after simpler and more basic ideas have been presented. These substances that are neither decomposed nor synthesized are called *elements*. Familiar elements are oxygen, sulphur, iron, carbon, hydrogen, and 15 or 20 others, although nearly 100 elements are known. Elements combine with each other to form compounds. On the other hand, compounds may break up into elements. One element may drive another out of a compound and take its place. Two compounds may exchange elements to form new compounds. A certain group of elements may

remain together through chemical changes while other elements in the compound are exchanged or replaced. Such groups are called *radicals*.

Two elements may combine in several different ways to form different compounds. However, it is a striking fact that in such cases, if the quantity of one element in these several compounds is fixed at a certain value, the quantities of the second element in these compounds bear a very simple relationship to each other. For example, 28 grams of nitrogen will combine with 16, 32, 48, 64, and 80 grams of oxygen to form 5 different compounds. There are respectively 2, 3, 4, and 5 times as much oxygen as in the first compound.

Thus it is possible to assign a numerical value to each element that will represent the quantity that will combine with another element. Thus if the value of 16 is given to oxygen, either 16 grams or some simple multiple of 16 represents the combining proportions of oxygen in all of its compounds. (See also **ELEMENTS**.)

Atomic Theory.—These remarkable quantitative relationships characteristic of chemical changes are satisfactorily explained by the atomic theory (q.v.), first proposed by John Dalton early in the 19th century and modified more than one hundred years later by other fundamental discoveries. In its simplest terms this theory may be stated as follows: The elements are made up of exceedingly small particles called atoms that are incapable of further subdivision. The word *atom* means indivisible. Incidentally, the idea of a limit to the subdivision of matter went back to the ancient Greek philosophers, but was without experimental proof. The atoms of one element are all exactly alike, but are different from the atoms of all other elements. Chemical reactions are between one atom of one element and one atom of another element or between very small numbers of each. This accounts for the simple and multiple proportions just discussed. If all atoms of iron have the same weight and this is true of the atoms of sulphur, and if one atom of iron combines with one atom of sulphur to form iron sulphide, then the same weight relations would hold good if a billion billion atoms of iron combined with a like number of sulphur atoms. Also, if 1 atom of oxygen combined in one instance with 1 atom of copper and in another with 2 atoms of copper, the relation between the weights of copper in the two compounds would be the simple ratio of 1 to 2. The atomic theory has had to be modified to a certain extent by the discovery that the atoms of an element are not all alike in weight. What is now called an element is a form of matter all of whose atoms have the same atomic number, that is, the same number of protons in the nucleus and the same number and arrangement of electrons outside the nucleus. These different forms of the same element are called *isotopes*. However, the isotopes of each element are so thoroughly mixed that a very precise value can be assigned to represent their average weight, and this is the value that is commonly given as the atomic weight of an element. This will be discussed more fully as individual elements are taken up. (See page 407b.)

Those values chosen to represent the relative weights of the atoms of the elements on the basis of a great many analyses of compounds have been further confirmed by an observation

first made by the French physicists, Pierre Louis Dulong and Alexis Thérèse Petit, that the products of the specific heats of many elements in the solid state and the weights commonly accepted as representing the combining proportions of these elements have the same value. It would appear reasonable that the same quantity of heat is required to raise equal numbers of atoms of elements in the solid state through the same temperature interval. This principle has been used in determining the correct value to be assigned to a new element.

X-rays are employed to determine the number and arrangement of atoms in crystals. The distance between atoms is of about the same order as the wave lengths of X-rays. By passing X-rays through a thin crystal or reflecting them from the crystal's surface and observing the deflections caused by the atoms, the distances between atoms and the ways in which they are spaced are accurately calculated. The weight of a given volume of metal is easily determined. If the number and spacing of the atoms are known, it is easy to calculate the weight of an individual atom. These weights are extremely small, and it is more satisfactory to assign an arbitrary weight to one atom and obtain values for other atoms that give the relative weights of each. These are known as *atomic weights*. Thus, if the relative weight of the oxygen atom is assumed to be 16 and it is known that an atom of molybdenum weighs exactly six times as much as an atom of oxygen, the value of 96 is assigned to the atom of that element. When definite units are required, that number of atoms is selected that would give the chosen value in a particular unit. The number of atoms of oxygen that weigh 16 grams is the same as the number of atoms of molybdenum that weigh 96 grams. This number is known and has been checked and proved by several independent methods. It is approximately 6×10^{23} , but this value enters into few chemical calculations.

Within the present century the great amount of new information gained about the structure of atoms makes very much more credible the regularities with which different kinds of atoms combine. The phenomena accompanying the discharge of electricity through gases under very low pressures led not only to the discovery of X-rays, or very short wavelength vibrations of the same nature as light, but also to the concept of the electron as one of the fundamental units of which atoms are composed. The discovery of the radioactive elements contributed further evidence to the knowledge of atomic structure. As radioactive elements disintegrate, particles are given off that have several thousand times the mass of the electrons that are also released from radioactive elements. These *alpha particles* are very powerful projectiles, and the extent and frequency of their deflections as they passed through thin sheets of different solid elements and recorded their impacts on a photographic plate gave a picture of the internal structure of atoms. All of this work is too complicated to be considered here, but is merely cited to show the nature of the evidence on which the modern picture of atomic structure is based.

While only very little understanding of subatomic phenomena can be had without abstruse mathematics (some of it specially devel-

oped to account for the behaviors of particles that have no analogy in the movements of objects that can be seen), chemists have made highly simplified pictures of different atoms that enable them to explain many of the facts of chemistry.

Only three kinds of particles are needed to make these pictures of atoms, although other kinds of particles have been discovered. These three are electrons, protons, and neutrons. The *electron*, as far as chemists are concerned, is a particle of about $1/1840$ the mass of a hydrogen atom that has a negative charge. This is the smallest charge that has ever been measured and is regarded as a unit of electrical charge. A current of electricity is a stream of electrons or negative electrical particles. Physicists have a much more complicated idea of the electron, involving the ideas of waves and vibrations, which fits the observed facts, but a very simple concept is enough to satisfy chemists for some time to come. The *proton* is a positive particle that has almost the same mass as the hydrogen atom, but has a positive charge exactly equal to the negative charge of the electron. For a long time chemists were content with these two particles, but a third kind of particle is now employed in describing the inner structure of the atom. A *neutron* also has about the same mass as the hydrogen atom, but has no charge whatever.

The simplest of all the atoms is that of hydrogen, since it is made up of a single proton and a single electron. The two make up a very simple "one sun and one planet" system, the electron moving around the proton as the earth moves about the sun. The distance between the two is relatively as great. The calculations describing the behavior of the one electron, however, would fill many pages.

Another type of atom is approximately twice as heavy as hydrogen but behaves exactly like hydrogen. It is made up of one proton and one neutron, which are very close to each other and which together make up the *nucleus* of the atom. Around this nucleus there moves a single electron just as in the hydrogen atom. As far as everyday chemistry goes, hydrogen as it is liberated from water, acids, or hydrocarbons, is a mixture of about 99.98 per cent of ordinary hydrogen and 0.02 per cent of this other kind of hydrogen called deuterium. The two are isotopes, a term whose meaning will be more apparent later.

The next heavier element is *helium* (q.v.). Evidence for the existence of this element was obtained from the spectrum of the sun some years before it was discovered on the earth. Some natural gas contains as much as 1 per cent helium, and it is now separated in commercial quantities. The helium atom is made up of a nucleus of 2 protons and 2 neutrons around which 2 orbital electrons move. This pair of electrons next to the nucleus represents a balanced and stable arrangement so that helium refuses to combine with any other element. An alpha particle, made up of 2 protons and 2 neutrons, is merely a helium nucleus which has escaped from the large nucleus of a radioactive element. Traveling 20,000 times as fast as a rifle bullet, it is a most powerful projectile. Once stopped, an alpha particle picks up from the abundant supply of stray electrons the 2 electrons that it needs and becomes a harmless

helium atom.

This pair of electrons next to the nucleus is present in all other kinds of atoms heavier than helium. Arranging the atoms in increasing order of numbers of electrons in their orbits, the nucleus of each is also made up of an exactly correspondingly increasing number of protons. The increase in the mass of the nucleus is not regular, but each element has an atom with one more proton and one more electron than the one next below it, and one less of each than the one next above it. After helium, which has 2 electrons, the next element, *lithium*, has a third electron which moves at a considerably greater distance from the nucleus than the other two. Eight electrons represent the limit of this second planetary system or state. A new system begins until the limit of the third orbit's capacity is reached. The number of neutrons is irregular, but in the heavier elements averages an increase of two from one element to the next. As many as 32 electrons may be in an inner orbit or shell; others have 18; but the innermost shell is always made up of 2 electrons; the second of 8 electrons; and never more than 8 electrons are found in the outermost shell. (For structure of typical elements see Table 1 under ATOMIC THEORY.)

The number of protons in the nucleus is always equal to the number of electrons outside the nucleus. This is the *atomic number* of the element. Isotopes have the same atomic number but differ in the composition of the nucleus. The hydrogen isotopes have been discussed. Nearly all other elements are made up of several isotopes. For example, neon always has 10 protons in its nucleus and 10 electrons in its two electron shells, there being 2 electrons in the first shell and 8 in the second. The three isotopes of neon have respectively 10, 11, and 12 neutrons in their nuclei. Assigning the value of 1 to both the proton and the neutron and neglecting the electron's weight, the atomic weight of an element made up of several types of atoms is the average weight of the different isotopes. Since there is very little of the 21 isotope, and about nine times as much of the 20 as the 22, the average weight of neon atoms is 20.2 in comparison with the standard of oxygen as 16. (See ATOMIC THEORY, Tables 2 and 3, for a list of the stable isotopes of the elements; ELECTRON THEORY.)

Symbols.—The symbol of an element is derived from the first letter or the first letter and one other letter of its name in some language. The symbols are not all derived from the English names. Sodium has the symbol Na, from the Latin word *natrium*. The Latin name for silver is *argentum* and for gold *aurum*. When more than one element begins with the same letter, a second letter is used to differentiate the symbols.

Radioactive Changes.—Radioactive disintegrations producing new and different elements involve nuclear changes. In one type of radiation a neutron appears to have broken up into a proton and electron, and the electron leaves the atom almost at the speed of light as a beta ray. To balance the additional positive charge on the nucleus, the atom adds an electron to its outermost electron shell. In a second type of radiation, 2 protons and 2 neutrons leave the nucleus as an alpha particle, which travels at about 1/10 the speed of light. The loss of

2 protons lowers the positive charge on the nucleus by 2 units, and 2 electrons are ultimately lost from the outermost electron shell. (See also RADIOACTIVITY.)

Transmutations.—Alpha particles were first used as projectiles to produce transmutation of elements by breaking up the nuclei of atoms. Protons from hydrogen and the nuclei of deuterium are driven by strong electric fields developed in a cyclotron at such high speeds that they are most effective projectiles. Neutrons released by such bombardments have very powerful effects because they are without charge and hence pass through electron shells with little difficulty. A neutron moving slowly enough to be retained in a nucleus causes profound change in the atom. Electrons travelling at nearly the speed of light and also gamma rays produce nuclear reactions.

By such bombardments it is possible to alter the nuclei of a number of elements so that other elements result. In some cases the resulting nucleus is stable, and in others the element made by the transmutation are radioactive and undergo further changes. Aside from great theoretical interest, these synthetic radioactive elements have practical value in treatment of disease and in the study of reactions in living matter. The production of plutonium from uranium with the intermediate formation of neptunium, and the chain reactions caused by capture of slow neutrons which lead to rapid fission of both plutonium and uranium 235 made possible the atomic bomb.

Valence and Chemical Combination.—Chemical reactions are now considered as being due to gain, loss, or sharing of the electrons from the outer shells of atoms. The number of atoms of an element that will combine with an atom of another element is called its *valence*. Hydrogen and chlorine have been employed for many years as valence standards. The valence of a given element is commonly defined as the number of atoms of hydrogen or of chlorine with which one atom of the element will combine or which it will displace. Thus oxygen has a valence of 2 since it combines with 2 atoms of hydrogen in water. Carbon combines with 4 atoms of chlorine and is given a valence of 4. According to the modern idea of the structure of the atom, hydrogen has one electron which enters into combinations. Chlorine has 7 electrons in its outermost electron shell and takes one more to make a stable shell of 8. Neon has 8 electrons in its outermost shell and is entirely unreactive.

A simple method of representing valence and depicting chemical reactions thereby is to allow the symbol of an element to stand for the nucleus and all of the electrons except those in the outermost shell. This part of the atom is often called the *core*. Thus oxygen has a nucleus of 6 protons and 6 neutrons, a first shell of 2 electrons, all of which constitute its core, and a second shell of 6 electrons. The outer electrons are shown as small circles beside the core, and the atom of oxygen written $\text{8}\overset{\circ}{\underset{\circ}{\text{O}}}\text{8}$. Similarly hydrogen is H[•]

sodium, Na[•]; calcium, Ca^{••}; aluminum, Al^{•••}; carbon, $\text{6}\overset{\circ}{\underset{\circ}{\text{C}}}\text{6}$; chlorine, $\text{17}\overset{\circ}{\underset{\circ}{\text{Cl}}}\text{17}$; and neon, $\text{10}\overset{\circ}{\underset{\circ}{\text{Ne}}}\text{10}$. There are two extremes in chemical combination

dors of some substances and the taste of many more are undertaken with considerable caution because of their possible poisonous character. The weight of a given volume under given conditions, otherwise called *density* or *specific gravity*, is a property of every substance. Water is the common standard of comparison of solids and liquids, while gases are generally compared with hydrogen or with air. The temperatures at which a solid melts and a liquid boils under a given pressure are physical constants that are also properties of these substances.

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Molecules escape from the surface of a liquid, and in a closed container partially filled with liquid, the rate of escape is quickly equaled by the rate of return of the gaseous or vapor molecules to the liquid state. The higher the temperature, the more rapid is the rate of escape and of return, and the higher the pressure exerted by the molecules of the vapor. There is a similar escape and return from the surface of a solid, although for many solids the tendency is not measurably great.

When heat is applied to a solid, the vibrations of its particles increase in intensity, and at a certain point molecules escape from the surface to form a liquid. At this point the temperature does not rise further until all the solid disappears. Before this happens, if no heat is applied and its escape is prevented by insulation, there will be an equality in the number of molecules escaping or returning to the solid state, or what is known as an equilibrium.

A solution refers to a mixture of molecules of two or more substances. Ions, which are charged particles, made up of one or more atoms function like molecules in solution. Gases mix in all proportions and there are solid solutions, but the term *solution* is generally thought of as a mixture of molecules in the liquid state. Some liquids mix in all proportions, but there is usually a definite limit of the solubility of one substance in another. Solubility changes with temperature, but whether it decreases or increases depends on the nature of the substances involved.

When a membrane is interposed between a liquid that is a single substance and a solution of one substance in another, it often happens that one kind of molecule will pass through the membrane and another kind will not. For example, a solution of sugar in water divided by a membrane from water will lose water molecules from the solution. A definite pressure on the water side is required to cause the water molecules to pass at equal rates through the membrane. This *osmotic* pressure has the quantitative aspects of gas pressures. (See also **MATTER**.)

Characteristics of Chemistry.—Chemistry is primarily the science of the transformations of substances into other substances. Two or more substances may combine to form a new substance; a substance may decompose into other substances; and other changes may take place that seem more impossible and unexplainable. Iron and sulphur are substances with very marked and unmistakable properties. One is dense, gray, and insoluble, and is attracted by a magnet. The other is much less dense, is yellow, is soluble in certain solvents, and is not affected by a magnet. The two substances can be ground and mixed and then separated, either by dissolving the sulphur in carbon bisulphide or by drawing out the iron by a magnet. If the mixture is heated, it will remain hot for some time after the source of heat is withdrawn, and the product has none of the properties of iron or sulphur, but a new set of properties of its own. A red solid known as mercuric oxide is converted by heating into liquid mercury and gaseous oxygen. Metallic zinc dissolves and

disappears in a solution of sulphuric acid in water; gaseous hydrogen escapes; and removal of the water leaves a white solid called zinc sulphate. In this case two substances are converted into two other substances. These are chemical transformations. The melting of iron and its crystallization from the liquid state; the dissolving of sulphur in carbon bisulphide; the passing of an electric current in a coil around a mass of iron to render it magnetic, all are thought of as physical changes. Only when new substances are formed is the field of chemistry really entered. However, there are so many close interrelations among the sciences that it is often very hard to draw sharp distinctions.

A second striking characteristic of all chemical changes is that definite quantities are always involved. Chemical reactions take place according to fixed proportions by weight, and in the case of gases, according to simple volume ratios. For example, slightly more than 2 grams of hydrogen will combine with 16 grams of oxygen to form approximately 18 grams of water. At the same time the volume of hydrogen that combines is just twice that of oxygen. If the two substances were present in different proportions from these, some of one or the other would remain uncombined. The quantities involved have been determined with the utmost care, and the same results have been obtained a great many times, so that the law of definite proportions has been thoroughly established. This law in turn depends on the law of conservation of mass, which is that in any isolated system, or portion of the universe set aside for observation, there is neither gain nor loss of matter. This also applies to energy. A small loss in weight has been observed in connection with atomic fissions and the formation of radioactive elements. This loss in weight is accompanied by evolution of enormous quantities of energy. Instead of considering the two, mass and energy, separately, modern science puts them together in the law of the conservation of mass-energy.

A third characteristic of chemical change is that definite quantities of energy are involved. Heat energy and electrical energy are the two types that are more commonly associated with chemical reactions, although other forms such as light energy or mechanical energy also accompany chemical changes. For example, 12 grams of carbon (graphite) combine with 32 grams of oxygen to form 44 grams of carbon dioxide with the evolution of 94,030 calories of heat.

Elements.—Certain substances cannot be decomposed by any ordinary chemical methods into other and simpler substances, nor can they be made by the combination of other substances. This generalization still holds in the common experience of chemists, and any modifications of this statement will be better understood after simpler and more basic ideas have been presented. These substances that are neither decomposed nor synthesized are called *elements*. Familiar elements are oxygen, sulphur, iron, carbon, hydrogen, and 15 or 20 others, although nearly 100 elements are known. Elements combine with each other to form compounds. On the other hand, compounds may break up into elements. One element may drive another out of a compound and take its place. Two compounds may exchange elements to form new compounds. A certain group of elements may

remain together through chemical changes while other elements in the compound are exchanged or replaced. Such groups are called *radicals*.

Two elements may combine in several different ways to form different compounds. However, it is a striking fact that in such cases, if the quantity of one element in these several compounds is fixed at a certain value, the quantities of the second element in these compounds bear a very simple relationship to each other. For example, 28 grams of nitrogen will combine with 16, 32, 48, 64, and 80 grams of oxygen to form 5 different compounds. There are respectively 2, 3, 4, and 5 times as much oxygen as in the first compound.

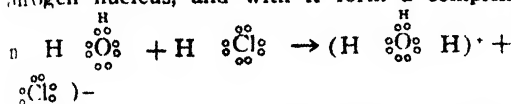
Thus it is possible to assign a numerical value to each element that will represent the quantity that will combine with another element. Thus if the value of 16 is given to oxygen, either 16 grams or some simple multiple of 16 represents the combining proportions of oxygen in all of its compounds. (See also ELEMENT.)

Atomic Theory.—These remarkable quantitative relationships characteristic of chemical changes are satisfactorily explained by the atomic theory (q.v.), first proposed by John Dalton early in the 19th century and modified more than one hundred years later by other fundamental discoveries. In its simplest terms, this theory may be stated as follows: The elements are made up of exceedingly small particles called atoms that are incapable of further subdivision. The word *atom* means indivisible. Incidentally, the idea of a limit to the subdivision of matter went back to the ancient Greek philosophers, but was without experimental proof. The atoms of one element are all exactly alike, but are different from the atoms of all other elements. Chemical reactions are between one atom of one element and one atom of another element or between very small numbers of each. This accounts for the simple multiple proportions just discussed. If all atoms of iron have the same weight and this is true of the atoms of sulphur, and if one atom of iron combines with one atom of sulphur to form iron sulphide, then the same weight relations would hold good if a billion billion atoms of iron combined with a like number of sulphur atoms. Also, if 1 atom of oxygen combined one instance with 1 atom of copper and another with 2 atoms of copper, the relation between the weights of copper in the two compounds would be the simple ratio of 1 to 2. Atomic theory has had to be modified to a certain extent by the discovery that the atoms of an element are not all alike in weight. What is now called an element is a form of matter of whose atoms have the same atomic number, that is, the same number of protons in the nucleus and the same number and arrangement of electrons outside the nucleus. These different forms of the same element are called *isotopes*. However, the isotopes of each element are so thoroughly mixed that a very precise value can be assigned to represent their average weight, and this is the value that is commonly given as the atomic weight of an element. This will be discussed more fully as individual elements are taken up. (See page 407b.)

Those values chosen to represent the weights of the atoms of the elements on the basis of a great many analyses of compounds have been further confirmed by an obse

chemical reactions without themselves being changed are called *catalysts*. The effect of a catalyst is exactly the same on the two opposing reactions in a chemical equilibrium. Substances that function as catalysts are generally characterized by possessing large and active surfaces on which the reacting materials are attracted. Notable examples of catalysis are the effects of finely divided platinum on the oxidation of sulphur dioxide, of spongy iron containing small amounts of other elements on the combination of nitrogen and hydrogen, and of powdered manganese dioxide on the decomposition of potassium chlorate.

Ionization.—Reference has been made to that type of chemical combination in which electrons are completely transferred from one atom to another. Such substances, when dissolved in water, break up into charged particles known as *ions*, and this process of dissociation is called *ionization*. The water appears to insulate the ions from each other so that they can maintain a separate existence and function just as molecules in a solution. Water molecules also tend to combine with ions by virtue of either one of the pairs of unshared electrons which each water molecule has. A water molecule, for instance, will capture a proton, or the hydrogen nucleus, and with it form a complex



Those substances in which electron transfer is complete and also those which permit the removal of an atom or group of atoms by water are regarded as being completely ionized in solution. Their solutions readily conduct an electric current by this mechanism, as illustrated by copper chloride, CuCl_2 . This substance ionizes into copper ions, Cu^{++} and 2 chloride ions, Cl^- . If 2 electrodes of inert material that dip into a copper chloride solution are connected to a source of current such as a dynamo or battery, which may be thought of as an *electron pump*, electrons will be drawn out of one electrode and forced into the other. The deficiency of electrons in one and excess in the other is not great, but as soon as copper ions come in contact with the negative electrode, which has an excess of electrons, each copper ion will take 2 electrons ($\text{Cu}^{++} + 2 \ominus \rightarrow \text{Cu}^0$). At the same time 2 chloride ions will lose an electron each to the positive electrode and become chlorine molecules ($2 \text{Cl}^- \rightarrow \text{Cl}_2 + 2 \ominus$). The symbol \ominus indicates a free electron. The zero is the symbol of an element indicates that the element is neutral, or that it is without the excess of electrons indicated by a minus sign or above the symbol or without deficiency of electrons indicated similarly by plus signs. As copper metal is formed and deposited, the chloride ions will attract other copper ions. In the same way copper ions around the negative electrode will attract chloride ions. As long as there are any amounts of these two kinds of ions in solution, there will be a steady migration of ions, and a current will flow.

The fact that the quantity of electricity flows through a solution of an ionized compound is not as much as should be carried, on the basis of the number, charge, and speed of the ions was once interpreted as meaning that there is an equilibrium between the portion of the

compound that was not dissociated and the ions. Unless the discrepancy is very great, indicating only slight dissociation, the difference is explained by attractions between ions that slow down their movements and lessen the quantity of current.

Acids, Bases, Salts.—Those substances that ionize readily are grouped into three classes: acids, bases, and salts. The older definition of an *acid* is a substance that contains one or more atoms of hydrogen that become hydrogen ions in solution. Now it is generally agreed that free protons do not exist in solution. Water or some other substance must combine with the proton to form what is still often written H^+ , but which should be H_3O^+ or some other group of a similar nature. Hence acids are proton donors. A *base* is still very commonly thought of as a substance containing one or more hydroxyl (OH) groups that would give hydroxyl ions (OH^-) in solution. According to the more modern idea, hydroxyl and many other groups or even neutral compounds are bases because they accept protons. The hydrogen of an acid and the hydroxyl of a base combine readily to form water, which ionizes to the extent of only a few molecules out of every billion. The older way of expressing the reaction was $\text{H}^+ + \text{OH}^- \rightarrow \text{H}_2\text{O}$. The more modern way is $\text{H}_3\text{O}^+ + \text{OH}^- \rightarrow \text{H}_2\text{O} + \text{H}_2\text{O}$. *Salts* are made up of the same positive ions that are present in bases and the same negative ions that are in acids. Thus H_2SO_4 is sulphuric acid and $\text{Ca}(\text{OH})_2$ is calcium hydroxide, a base, while CaSO_4 is calcium sulphate, a salt. Most salts ionize completely. Even those that dissolve in water to a very slight extent are represented in the liquid phase solely by ions.

If a solution of sodium chloride, which is essentially a solution of sodium ions (Na^+) and chloride ions (Cl^-), is mixed with a solution of potassium nitrate containing potassium ions (K^+) and nitrate ions (NO_3^-), no reaction will take place. It is necessary that a substance be formed that is either not ionized or that is insoluble. If equimolecular quantities of an acid and a base, each in solution, are mixed, the hydrogen and hydroxyl ions will form water, heat will be evolved as an evidence of reaction, and the other two kinds of ions will remain as they were.

In the same way mixtures of a solution of silver nitrate and sodium chloride will result in the formation of insoluble silver chloride, and only sodium ions and nitrate ions will remain in solution.

Ionic Equilibria.—Many substances, especially compounds of carbon, show no evidence of appreciable ionization. Others, however, undergo a small but entirely measurable degree of ionization. These include mainly what are called *weak acids* and *weak bases*. Boric acid, H_3BO_3 , ionizes so slightly that a solution of it may be applied to the eye without injury. Even very dilute hydrochloric acid (HCl), will cause intense pain to the eye surface. It is certainly not an effect of the chloride ion, since a solution of sodium chloride contains chloride (Cl^-) ion and causes no pain. The difference is in the concentration of the hydrogen ions. Because of its familiarity this may still be written $[\text{H}^+]$ although $[\text{H}_3\text{O}^+]$ is understood.

In the case of weak acids and weak bases, there is a definite equilibrium between the compound and its ions. The product of the concen-

tration of the ions divided by the concentration of the unchanged compound is a constant value at a given temperature and is given the name *ionisation constant*.

Another striking fact is that in saturated solutions of very slightly soluble substances, the product of the concentrations of the ions present is a constant at a given temperature. Variations from this principle are due to interionic attractions, which are very slight with the small number of ions furnished by the more insoluble substances. The concentrations of the two types of ions may be very different and still the product is a constant. This *solubility product* principle is the basis of an important part of quantitative analysis. With it is coupled the concept of ionization constants. Thus, ammonium hydroxide in water solution dissociates slightly into ammonium ions (NH_4^+) and hydroxyl ions (OH^-). If considerable quantities of ammonium ions are added from an ammonium salt, the hydroxyl ion concentration is greatly suppressed, since it must change to compensate for the increase of the concentration of the other kind of ion. The concentration of the ammonium hydroxide cannot change much since it already represents most of what is in solution. Concentrations are expressed by inclosing symbols and formulas in brackets.

$$\frac{[\text{NH}_4^+][\text{OH}^-]}{[\text{NH}_3][\text{H}_2\text{O}]} = A \text{ constant.}$$

If a magnesium salt is added to a solution of ammonium hydroxide, insoluble magnesium hydroxide, $\text{Mg}(\text{OH})_2$, will be formed. If there is an excess of ammonium ions, there will be so few hydroxyl ions that the solubility product value of magnesium hydroxide is not reached and no precipitation takes place. Hydrogen sulphide in water solution is hydrosulphuric acid, and is a very weak acid. Many sulphides are quite insoluble. By employing varying amounts of other acids as a source of hydrogen ions and other substances that will act similarly, it is possible to separate, detect, and estimate a number of metals that form comparatively insoluble sulphides.

The solubility product principle represents an ideal solution. The actual concentrations should be corrected by factors in order to obtain the effective concentrations or activities of the ions involved. Some authors prefer to use the term activity product rather than solubility product. With these modifications the principle has wide applications both in chemical analysis and in manufacturing operations.

Electromotive Force.—The tendency of ions or of elements to gain or lose electrons may be measured as an electromotive force. Reactions involving electron transfers are also a commercial source of electric current. When zinc and bromine are brought into contact with each other, they combine with the evolution of heat and the reaction is written as $\text{Zn} + \text{Br}_2 \rightarrow \text{ZnBr}_2 + \text{heat}$. If metallic zinc as an electrode is in contact with a solution of zinc ions, and bromine is dissolved in a bromide solution in which there dips an inert electrode, and if the two solutions are connected by a column of liquid in which a salt is dissolved, and the electrodes are connected through electrical measuring equipment, a current will flow but no heat will be developed. The quantity of current will be proportional to the quantity of zinc and bromine used up just as the quantity of

heat is similarly proportional to the amount of each that has reacted in the case of ordinary combination. Exactly the same shift of electrons takes place, but instead of direct transfer, the electrons pass through a wire and are measured with instruments. The ion reactions are: $\text{Zn}^0 \rightarrow \text{Zn}^{++} + 2 \ominus$, and $\text{Br}_2 + 2 \ominus \rightarrow 2 \text{Br}^-$. Each reaction takes place entirely separate and apart from the other, and the reacting substances may never come in contact with each other.

The intensity of the reaction or the extent of the driving force, as electrons are gained or lost, is measured in volts, and the combined effect, together with quantities of materials that react, will determine the energy of the reaction. The electrical energy produced by two half cells, when the reactants are separated, is exactly the same as the heat energy produced when the reactants are in contact, if the same quantities are used up in each case.

Other types of reactions whose electromotive force may be measured are displacements and changes in valence. The tendency to gain or lose electrons is also a function of the concentration of the ions in a solution. Although the difference between the electromotive forces of two solutions of different concentrations of the same substance is not great, it may be measured readily and used as a method of analysis. The hydrogen ion concentration of a solution is often very important, and delicate instruments employing electronic tubes compare the unknown solution with a solution of known hydrogen ion concentration by measuring the electromotive force difference of the two solutions.

An important type of reaction is referred to as an *oxidation-reduction* reaction. Many of these can be carried out in cells as a source of current, so that the potentials or driving forces of each element or ion may be measured. Others can be described and explained on the same basis of electron transfer, even though electrical measurements cannot be made. The term *oxidation* originally meant combination with oxygen and *reduction* removal of oxygen, but similar reactions involve no oxygen. The terms now mean loss of electrons in oxidation and gain of electrons in reduction. The combination of zinc and bromine, involving no oxygen, was an oxidation-reduction reaction.

One of the oldest types of galvanic cell for production of an electric current was made up of zinc and copper dipping into a solution of copper sulphate. The electrode reactions were $\text{Zn}^0 \rightarrow \text{Zn}^{++} + 2 \ominus$, and $\text{Cu}^{++} + 2 \ominus \rightarrow \text{Cu}^0$. Zinc dissolved, copper plated out, while the sulphate ion (SO_4^{--}) remained unchanged. The modern dry cell is essentially a zinc-hydrogen cell. The source of hydrogen is the ammonium ion of ammonium chloride. Hydrogen does not escape because it is made to combine with the oxygen of manganese dioxide. Ammonia forms a complex compound with zinc chloride and remains. The cell is not dry, the solution being either in the form of a jelly or held by absorbent materials so that no liquid flows.

While many cells cannot be restored to their original condition and are thus called *primary cells*, there is an important place in the practical field for a type of cell in which the products of the reaction that produced the current can be converted by a reversal of the original reaction to the starting substances. The economy of these *secondary cells* lies in their portability and the

utility of small units that can be recharged when they are not in use. The lead-sulphuric acid storage battery is explained by this reversible reaction.

$\text{Pb} + \text{PbO}_2 + 2 \text{H}_2\text{SO}_4 \rightleftharpoons 2 \text{PbSO}_4 + 2 \text{H}_2\text{O}$. The electrode reactions are $\text{Pb}^0 \rightleftharpoons \text{Pb}^{++} + 2 \text{e}^-$, and $\text{Pb}^{++++} + 2 \text{e}^- \rightleftharpoons \text{Pb}^{++}$. The electrodes are lead grids containing at first spongy lead at the negative and lead dioxide at the positive. The electrolyte is a water solution of sulphuric acid containing about 30 per cent of this acid. When the grid material of both electrodes has been changed to lead sulphate, in which the lead atoms are minus 2 electrons (Pb^{++}), the battery is recharged by the passage of a current and the neutral lead and the lead minus 4 electrons (Pb^{++++}) of the lead dioxide are restored. The nickel-iron battery depends on the shift of electrons of this type: $\text{Fe}^0 \rightleftharpoons \text{Fe}^{++} + 2 \text{e}^-$, and $\text{Ni}^{+++} + 2 \text{e}^- \rightleftharpoons \text{Ni}^{++}$. See also ELECTROCHEMISTRY; ELECTROLYSIS.

Periodic System.—The elements may be classified and arranged according to their properties in what is known as the periodic system. This is more fully discussed in another volume. (See PERIODIC LAW). Briefly, the principle is expressed in the periodic law which states that "the properties of the elements are periodic functions of their atomic weights." When the elements are arranged in ascending order of their atomic weights, there is a regular or periodic recurrence of certain properties so that elements may be arranged in groups or families. Active metals, which are electropositive elements, are grouped together, and likewise active nonmetals or electronegative elements fall into separate groups. This principle has been of great value in leading to the discovery of new elements as well as to decisions as to the correct atomic weight and valence of others that have long been known. There were, however, several defects and discrepancies that could not be cleared up as long as the determining factor was atomic weight.

The modern periodic system shifts the emphasis to atomic number. It is therefore necessary to amend the periodic law thus: "The properties of the elements are periodic functions of their atomic numbers." It will be remembered that the atomic number of an element is the number of protons in its nucleus, which is also the number of electrons in shells or orbits around the nucleus. The electrons in the outermost shell are involved in chemical reactions, but the positive nucleus has a great influence on the reactivity of an element. By making this change, the difficulties of the older system vanish. These elements that are alike have the same types of electron shells as far as the outermost and next innermost shells are concerned. Thus sodium and potassium each have one electron in the outermost shell and 8 in the next underlying shell. The "rare earth" elements, which found no place in the old periodic system, are regarded as being alike in all respects except one electron shell and, of course, increasing size of nucleus. Each has the same number of electrons in the outermost or valence shell and hence they are very much alike. The fact that argon atoms on an average are heavier than potassium atoms, and tellurium atoms heavier than iodine atoms, while their positions are reversed in the old periodic system because of their properties, has no meaning under the new system. Potassium has an atomic number of 19 and argon of only 18,

while iodine's atomic number is 53 and that of tellurium is 52. The original discrepancy was due to the heavy isotopes of some of these elements.

INTERNATIONAL ATOMIC WEIGHTS

1947

Journal of the American Chemical Society

	Symbol	Atomic number	Atomic weight
Aluminum	Al	13	26.97
Antimony	Sb	51	121.76
Argon	A	18	39.944
Arsenic	As	33	74.91
Barium	Ba	56	137.36
Beryllium	Be	4	9.02
Bismuth	Bi	83	209.00
Boron	B	5	10.82
Bromine	Br	35	79.916
Cadmium	Cd	48	112.41
Calcium	Ca	20	40.08
Carbon	C	6	12.010
Cerium	Ce	58	140.13
Cesium	Cs	55	132.91
Chlorine	Cl	17	35.457
Chromium	Cr	24	52.01
Cobalt	Co	27	58.94
Columbium	Cb	41	92.91
Copper	Cu	29	63.54
Dysprosium	Dy	66	162.46
Erbium	Er	68	167.2
Europium	Eu	63	152.0
Fluorine	F	9	19.00
Gadolinium	Gd	64	156.9
Gallium	Ga	31	69.72
Germanium	Ge	32	72.60
Gold	Au	79	197.2
Hafnium	Hf	72	178.6
Helium	He	2	4.003
Holmium	Ho	67	164.94
Hydrogen	H	1	1.0080
Indium	In	49	114.76
Iodine	I	53	126.92
Iridium	Ir	77	193.1
Iron	Fe	26	55.85
Krypton	Kr	36	83.7
Lanthanum	La	57	138.92
Lead	Pb	82	207.21
Lithium	Li	3	6.940
Lutecium	Lu	71	174.99
Magnesium	Mg	12	24.32
Manganese	Mn	25	54.93
Mercury	Hg	80	200.61
Molybdenum	Mo	42	95.95
Neodymium	Nd	60	144.27
Neon	Ne	10	20.183
Nickel	Ni	28	58.69
Nitrogen	N	7	14.008
Osmium	Os	76	190.2
Oxygen	O	8	16.0000
Palladium	Pd	46	106.7
Phosphorus	P	15	30.98
Platinum	Pt	78	195.23
Potassium	K	19	39.096
Praseodymium	Pr	59	140.92
Protactinium	Pa	91	231
Radium	Ra	88	226.05
Radon	Rn	86	222
Rhenium	Re	75	186.31
Rhodium	Rh	45	102.91
Rubidium	Rb	37	85.48
Ruthenium	Ru	44	101.7
Samarium	Sm	62	150.43
Scandium	Sc	21	45.10
Selenium	Se	34	78.96
Silicon	Si	14	28.06
Silver	Ag	47	107.880
Sodium	Na	11	22.997
Strontium	Sr	38	87.63
Sulfur	S	16	32.066
Tantalum	Ta	73	180.88
Tellurium	Te	52	127.61
Terbium	Tb	65	159.2
Thallium	Tl	81	204.39
Thorium	Th	90	232.12
Thulium	Tm	69	169.4
Tin	Sn	50	118.70
Titanium	Ti	22	47.90
Tungsten	W	74	183.92
Uranium	U	92	238.07
Vanadium	V	23	50.95
Xenon	Xe	54	131.3
Ytterbium	Yb	70	173.04
Yttrium	Y	39	88.92
Zinc	Zn	30	65.38
Zirconium	Zr	40	91.22

Elements Found in Nature.—Since a number of new elements have been produced by the impact of various particles such as neutrons, hydrogen, deuterium, and helium nuclei as previously described, and since the isotopic composition of such elements varies with the method of production, the International Union of Pure and Applied Chemistry has voted not to include the atomic weights of these elements in their next official table. The most recent table approved by this organization is given above. It is probable that the value for Beryllium will be changed to 9.013.

The International Union of Pure and Applied Chemistry in 1949 adopted certain changes in official names, only three of which affect the above table. The spelling of "lutecium" is changed to "lutetium." The element given above as "Columbium" is to be known as "Niobium," a term common in England. The change which will require considerable time for Americans and English to adopt is "Wolfram" instead of "Tungsten."

Elements Artificially Produced.—The products of nuclear reactions include a large number of isotopes of elements found in nature and listed in the foregoing table. Following are elements whose existence in nature is not considered probable and which have been produced by the bombardment of nuclei of other elements by various particles.

Atomic number	Name	Symbol
43	Technetium	Tc
61	Promethium	Pm
85	Astatine	At
87	Francium	Fr
93	Neptunium	Np
94	Plutonium	Pu
95	Americium	Am
96	Curium	Cm

In 1949 Dr. Glen T. Seaborg and co-workers announced the production of Element No. 97 and early in 1950 of Element No. 98, and have proposed the names of Berkelium and Californium respectively for these two elements. Neptunium appears to be the first of a new series of elements resembling the "rare earth series."

Typical Elements.—A few typical groups will be discussed and some of the compounds of a few elements will be described.

What was thought to be nitrogen, when the other gases of the air had been removed, proved to be a mixture containing mainly nitrogen but also enough argon to constitute nearly 1 per cent of the air. This discovery was closely paralleled by finding a gas in very small amounts in the air and later in considerably larger amounts in natural gas whose spectrum was identical with a component of the sun. This element was named helium. The two representatives of a group necessitated the finding of other elements having the same properties, which led to the isolation of neon, krypton, and xenon from the air. The gas, radon, formed when radium disintegrates, was found to belong to this same group, and all the gaps in this group of the periodic table were thus filled. All of these gases but helium have 8 electrons in their outermost shell. Helium has only 2, but this arrangement next to the nucleus is also known to be very stable. None of these elements form compounds with other elements.

Hydrogen belongs to Group 1A and Period 1, being made up of a single proton as a nucleus

and a single orbital electron. The more common isotope, deuterium, has a nucleus of one proton and one neutron, but like hydrogen a single orbital electron. An atom of hydrogen may serve as a link between strongly electronegative atoms such as oxygen, nitrogen, and fluorine, the bond being weaker than a co-valent bond. The binding of water molecules together in this way accounts for some of the unique physical properties of this substance.

Lithium, sodium, potassium, rubidium, and cesium, each have one electron in their outer shells under which is a stable shell of 8 electrons, or in the lithium atom the stable innermost shell of 2 electrons. These elements are all electropositive, each losing their one valence electron in combining with other elements. Thus they all have a positive valence of 1. Their activity increases with increasing atomic weight, since the farther away the one valence electron is from the positive nucleus the more easily it is lost. All of these are metals, but their great chemical reactivity prevents their existence in the uncombined state unless they are protected from air and moisture. The salts of sodium and potassium are particularly important. Sodium chloride is a very abundant and useful compound. Their hydroxyl compounds are bases such as NaOH and KOH. Their oxides are called basic oxides, since they react with water to form bases. $\text{Na}_2\text{O} + \text{H}_2\text{O} \rightarrow 2\text{NaOH}$.

At the other side of the periodic table is the halogen family, fluorine, chlorine, bromine, and iodine. Each has 7 electrons in the outermost shell above cores that are like the complete atoms of helium, neon, argon, and krypton with respect to completed electron shells. It will be remembered that a core is the entire atom except the outer electron shell. In combining with most elements the halogens gain 1 electron to complete a shell of 8 electrons. The smaller the number of electron shells, the more active is the element, since the positive nucleus is nearer and attracts the single electron most strongly. Typical halides are: calcium fluoride, CaF_2 ; aluminum chloride, AlCl_3 ; potassium bromide, KBr ; and sodium iodide, NaI . The halogens except fluorine may lose one or more of their outside electrons to such a powerful electronegative element as oxygen. In this type of reaction, electrons are most easily lost from the element whose outer electrons are most distant from the positive nucleus. Chlorine liberates iodine from iodides, but iodine liberates chlorine from chlorates. Examples of compounds in which the halogen loses electrons are: chlorine monoxide, Cl_2O^+ ; chlorine dioxide, Cl_2O_2^+ ; sodium chlorate, $\text{Na}^+\text{ClO}_3^-$; and chlorine heptoxide, Cl_2O_7^+ . In so representing the positive or negative valences of atoms in compounds, it is not implied that the electrons are completely lost or gained or that the elements in these compounds form ions alone. It merely indicates that the element has lost or gained some of its electrons sufficiently to justify this method of marking its charge.

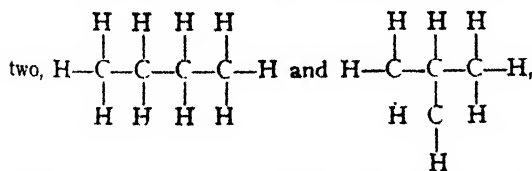
Oxygen is the most abundant of the elements in the earth's surface. It has 6 electrons in its outer shell and practically always acquires 2 electrons from other elements in combination. It is thus a powerful electronegative element. Oxygen alone does not form an ion in any measurable quantity. It is present in many negative ions such as hydroxyl, OH^- , Sulphate, SO_4^{2-} , nitrate, NO_3^- and phosphate, PO_4^{3-} . It combines

th most other elements. Sulphur resembles oxygen in having 6 electrons in its outer shell. Like the halogens it attracts enough electrons to make a shell of 8, but it also loses its electrons to very active negative elements. Typical sulphur compounds are the sulphides such as hydrogen sulphide, $\text{H}_2\text{S}^\ominus$, and copper sulphide, $\text{Cu}^\oplus\text{S}^\ominus$, and the acid oxides, $\text{S}^\oplus_4\text{O}_6^\ominus$ and $\text{S}^\oplus_6\text{O}_8^\ominus$ and their corresponding acids, sulphurous acid, $\text{H}_2\text{S}^\oplus_3\text{O}_3^\ominus$ and sulphuric acid, $\text{H}_2\text{S}^\oplus_4\text{O}_4^\ominus$.

Nitrogen has 5 electrons in its outer shell, it is the element, occurring as a gas whose molecule is made up of two atoms, N_2 , is extremely stable under rather severe conditions. Nitrogen takes up 3 electrons from 3 atoms of hydrogen to form ammonia, NH_3 , but loses one or more of its electrons in forming its oxides and oxyacids. The two most important nitrogen compounds containing oxygen are nitric oxide, NO^\ominus , and nitric acid, $\text{H}^\oplus\text{N}^\oplus\text{O}_3^\ominus$. Phosphorus, arsenic, antimony, and bismuth belong to the same family and form somewhat similar compounds. Antimony and bismuth have the physical properties of metals but their salts are not so stable in water as those of the more active metals, and even bismuth is associated with oxygen in negative ions.

Some metals such as chromium and manganese behave in their lower valences like the other metals. That is when they lose only 2 or 3 electrons, for example, they form positive ions. When a chromium atom loses all of its 6 electrons, its oxide, $\text{Cr}^\oplus_6\text{O}_4^\ominus$ is much like sulphur dioxide, $\text{S}^\oplus_2\text{O}_2^\ominus$. Both react with water to form strong acids. Manganese resembles chlorine in the oxide, $\text{Mn}^\oplus_2\text{O}_7^\ominus$ and in permanganic acid, $\text{H}^\oplus\text{Mn}^\oplus\text{O}_4^\ominus$.

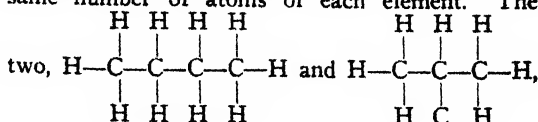
Carbon is a most remarkable element because of the varied nature of its compounds and their enormous number. Several times as many carbon compounds are known as those of all the other elements put together, and an infinite number are theoretically and structurally possible. Carbon has 4 electrons in its outer shell. It combines by sharing these electrons with those of other elements so that it is surrounded by a shell of 8 electrons. For example, a compound with hydrogen may be represented thus:



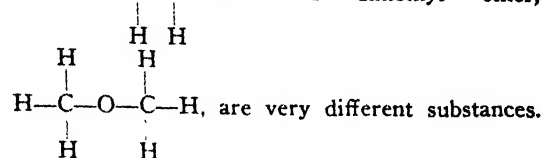
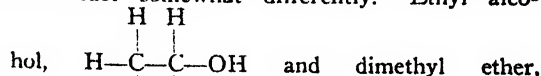
These may be written $\text{C}^\oplus_4\text{H}_{10}^\ominus$ and $\text{C}^\oplus_4\text{H}_8^\ominus$, but only when changes of valence are necessary to account for reactions. The sharing of electrons does not leave any atom strongly charged positively or negatively in most carbon compounds. The pair of bonding electrons in carbon compounds is more conveniently represented by a single line called a bond. If there are two or three pairs of electrons joining 2 carbon atoms or a carbon atom with another atom such as oxygen or nitrogen, two or three lines are employed.

Carbon has the remarkable property of combining with itself to build up rings and chains, some of the latter being of great length and complexity. The large number of carbon compounds is mainly due to the different ways in which carbon and other atoms are linked to-

gether. Thus, there are two different carbon-hydrogen compounds that are made up of the same number of atoms of each element. The




have markedly different physical properties and react somewhat differently. Ethyl alco-



Another cause of difference is due to different geometrical structures of compounds which have the same linkage of atoms. If four different substituents are attached to a carbon atom, two structures are possible, one being the mirror image of the other. The two structures are like a right hand and a left hand. Crystals and solutions of such unsymmetrical substances turn the plane of polarized light either to the right or the left, and are called *optically active* compounds.

Those compounds in which carbon atoms are linked together in straight or branching chains, and in which the maximum valence of 4 for carbon is always realized are called *aliphatic* compounds. Those compounds in which all the valences of carbon are not satisfied are referred to as *unsaturated*. A single line represents a pair of electrons, while two and three parallel lines indicate two and three electron pairs between atoms. Rings of six carbons in which each carbon apparently has the valence of 3 are known as *aromatic* compounds. Heterocyclic compounds are characterized by oxygen, sulphur or nitrogen atoms in rings.

For purposes of simplification all other compounds may be regarded as derived from hydrocarbons (made up only of carbon and hydrogen) by the replacement of one or more atoms of hydrogen by other elements or groups. Following are some common types of monosubstituted derivatives. In these the symbol R represents any hydrocarbon from which one hydrogen has been removed. ($-\text{CH}_3$ is methyl or methane less one hydrogen; and $-\text{C}_2\text{H}_5$ is ethyl from ethane.) $\text{R}-\text{OH}$, Alcohols; $\text{R}-\text{Cl}$, Alkyl chlorides; $\text{R}-\text{O}-\text{R}'$, Ethers; $\text{RH}(\text{C}=\text{O})$, Aldehydes; $\text{R}-(\text{C}=\text{O})\text{R}'$, Ketones; RCO_2H , Acids; $\text{RCO}_2\text{R}'$, Esters; $(\text{R}-\text{CO})_2\text{O}$, Anhydrides; RCONH_2 , Amides; RCOCl , Acid Chlorides; RNH_2 , R_2NH , and R_3N , Amines; RNO_2 , Nitro Compounds; RSO_3H , Sulphonic Acids.

The symbol  represents benzene, or C_6H_6 .

Several of these rings may be linked together with or without the sharing of carbons.

Many carbon compounds of infinite complexity such as rubber, cellulose, and protein may be broken up into units of relative simplicity. This tendency of many similar or identical units to

join together is peculiarly characteristic of carbon compounds.

Until well into the 19th century, carbon compounds were considered as entirely the product of some sort of life process, and the whole field of carbon chemistry was called organic chemistry. The term still remains in use, but the synthesis of many substances changed its meaning to the "chemistry of carbon compounds." In addition to all manner of products of animal and vegetable growth and of such fossil remains as coal, natural gas, and petroleum, a vast number of carbon compounds have been synthesized from simple sources.

Aliphatic and alicyclic hydrocarbons are found in nature primarily in petroleum and natural gas. A number of such hydrocarbons have been synthesized, but only when such syntheses added to the knowledge of chemical theory or when substances of special properties were needed. Those hydrocarbons in this class in which all four valences of the individual carbons are fully satisfied are relatively unreactive, and comparatively little use of these hydrocarbons was made as the original source of other substances until their abundance and further knowledge have made them more attractive as synthetic reagents. On the other hand, unsaturated hydrocarbons containing one or more double or triple bonds, that is two or three pairs of electrons, are quite reactive, and either add elements or groups or combine with each other to satisfy the condition of chemical saturation. Halogens, halogen acids, and other acids, such as sulphuric acid, add to unsaturated compounds most readily. For example, sulphuric acid adds to the simple olefin, ethylene, CH_2CH_2 , to form ethyl hydrogen sulphate, $\text{CH}_3\text{CH}_2\text{HSO}_4$, which is readily hydrolyzed to produce ethyl alcohol, $\text{C}_2\text{H}_5\text{OH}$, identical with "grain alcohol" resulting from the fermentation of sugar. The addition of a saturated to an unsaturated hydrocarbon, both of low molecular weight, is the basis of the "alkylation" process for making particularly efficient motor fuels. The combination of a number of molecules of the same unsaturated compound is the basis of the production of most modern plastics.

In those substances in which there is a ring of six carbons with three alternate double bonds, referred to above, the arrangement of binding electrons is such that there is not the same type of reactivity as in ordinary unsaturated hydrocarbons, and the reactions and compounds containing the "benzene ring" have appeared sufficiently different to chemists to justify a separate class of substances which are referred to as "aromatic" hydrocarbons. Modern theories, however, account for these differences so that all hydrocarbons can be considered together.

Although the direct action of an active halogen such as chlorine on an aliphatic hydrocarbon is a practical and commercial method for introducing an alkyl group into a compound, it is more common to begin with an alcohol in which the hydroxyl group (OH) replaces one of the hydrogens of the hydrocarbon. A number of the simpler alcohols are products of fermentation, notably ethanol or ethyl alcohol, $\text{C}_2\text{H}_5\text{OH}$. The simplest alcohol, methanol, CH_3OH , is readily made by the action of hydrogen on carbon monoxide at high pressure in the presence of a catalyst, and is also one of the products of the heating of wood in the absence of air. Other alcohols, notably those in which the carbon to which the

hydroxyl group is attached is linked to two or three other carbon atoms instead of one, are obtained from unsaturated hydrocarbons. Petroleum hydrocarbons are now being oxidized directly to form a variety of compounds. Alcohols are quite reactive and are the sources of most of the substances whose formulas were given in an earlier paragraph.

The term "carbohydrate" refers to a class of compounds made up of oxygen, hydrogen, and carbon, in which there are twice as many hydrogen as oxygen atoms. These were considered in the earlier years of organic chemistry as "hydrates" of carbon. They are now regarded as ring compounds with an oxygen atom taking the place of a carbon atom in the ring, and with hydrogen and hydroxyl groups attached to the carbon atoms. The simpler carbohydrates, whose structures are reasonably well known, are the sugars. More complex carbohydrates, in which a number of rings are linked together, include dextrin, starch, and cellulose. Such cellulose derivatives as nitrocellulose, cellulose acetate, and rayon are the results of reactions involving the hydroxyl groups, and are similar in their method of formation to the derivatives of the simpler alcohols.

Natural fats, oils, and waxes, both of animal and vegetable origin, are for the most part derivatives of acids, esters in which both glycerin, a trihydroxyl alcohol and monohydroxy alcohols are combined with fatty acids. A large part of this class of substances are foods, such as butter fat, lard, olive oil, soybean oil, and cottonseed oil. Breaking up of the esters results in soaps, fatty acids, and glycerin as commercial products.

An important class of substances, the proteins, are used both as foods and in commerce in the form of casein plastics, gelatin, and leather. Proteins are regarded as made up of one or more of the 24 naturally occurring amino acids by the elimination of water between the individual molecules by life processes. Substances analogous to the partial decomposition products of proteins in which the molecules are split and water is added have been synthesized. In the processes of metabolism, food proteins are broken down and the amino acids recombined to form the particular proteins of the body.

Still more complex substances such as dyes, plastics, and pharmaceuticals are the results of organic syntheses, in which relatively simple substances are progressively combined. On the other hand, natural products such as vitamins, hormones, and enzymes have been broken down so as to indicate their structures, and some have been synthesized. The whole field of carbon compounds is being explored with increasing thoroughness.

Silicon has the same outer electron shell as carbon, $\cdot\text{Si}\cdot$. Compounds of silicon are present

in clay, shale, and rocks of every sort except such materials as limestone and marble. This element resembles carbon in many ways, but forms relatively a much smaller number of compounds. Its hydrogen compounds are not stable and its atoms do not combine with each other as do carbon atoms. It is found mainly in combination with oxygen as SiO_2 and in silicates or salts of oxygen acids of silicon.

Colloids.—While almost any substance may exist in what is called the *colloidal state*, it is

so common in the field of carbon and silicon compounds that the topic may properly be introduced at this point. A colloidal *sol* refers to a dispersion of very small particles in a fluid medium of some sort. These particles contain many molecules, but their surfaces are so large in proportion to their masses that surface forces assume great importance. Colloidal particles are small enough to be deflected by the impact of molecules. They are also electrically charged, probably by having charged atoms or groups of atoms attached to them. For these reasons the particles remain dispersed in a fluid for an infinitely long time, whereas larger particles will ultimately settle. A colloidal jelly is made up of particles that attract and hold large amounts of solvent. When the solvent is driven out the remaining porous and quite rigid solid is known as a *gel*. Surfaces, particularly those which are greatly enlarged because of microscopically fine pores, are capable of attracting and holding other substances, a phenomenon known as *adsorption*.

Metals.—The salts of the metals of other groups behave in much the same way as those of the active metals. Many occur in natural deposits along with the oxides of these metals. The metals themselves, particularly those that have great mechanical strength, high electrical conductivity, and other desirable physical properties, are liberated from their compounds for industrial use. Some metals are deposited either from water solutions of their compounds or from molten salts by the use of the electric current. Still larger quantities are obtained as the free elements by removing other elements from their compounds under the influence of high temperatures. Carbon and carbon monoxide, CO, are the chief substances by which oxygen is commonly removed from metals. These procedures are discussed in other articles. See also ELECTRO-CHEMISTRY.

Divisions of Chemistry.—The science of chemistry is divided more or less arbitrarily into a variety of fields. The lines between them are often far from sharp. One major division is between carbon and its compounds and all other elements and their compounds. These two fields are still erroneously called organic chemistry and inorganic chemistry. The detection and determination of the quantities of elements and groups of elements as ions or compounds is the subject matter of analytical chemistry, which is further subdivided into qualitative analysis and quantitative analysis, depending on whether identification or measurement of quantity is involved. The terms biological, physiological, electrochemical, and metallurgical chemistry are largely self-explanatory. Physical chemistry refers primarily to a study of fundamental theories and principles with the help of the techniques and methods of the physicist. The major divisions of these five fields have been published by the National Roster of Scientific and Specialized Personnel with the advice of leading chemists specializing in each of these fields, and are as follows:

Physical Chemistry.—Thermodynamics and thermochemistry. Chemical kinetics (homogeneous and heterogeneous systems, catalysis, tracers). Chemical equilibria (homogeneous and heterogeneous equilibria, phase rule, alloys). Structure of gases, liquids, and solids (crystallography, the metallic state, X-ray and electron diffraction). Atomic and nuclear structure (isotopes, atomic fission, valence). Colloids and surface phenomena. Solutions (aqueous and nonaqueous, electromotive force,

ionic equilibria, conductance, diffusion, viscosity). Photochemistry (Raman spectra, infrared spectra, spectroscopy, effect of light on chemical reactions).

Theoretical physical chemistry (applications of quantum theory, statistical mechanics, physical applications of organic chemistry). Miscellaneous fields (polymers and polymerization, biophysical chemistry, low temperature phenomena).

Analytical Chemistry.—Qualitative analysis. Quantitative analysis (determination and measurement of properties by common methods, and separation of substances by volatilization, precipitation, extraction, and electro-deposition).

Special instrumental methods (polarizing microscope, refractometer, polariscope, turbidimeter, nephelometer, colorimeter, spectrograph, spectrophotometer, mass spectrograph and spectrophotometer, X-ray and electron diffraction equipment, potentiometer, polarograph, photoelectric cell, colorimeter, pyrometer, molecular still).

Microanalytical methods.

Analytical chemistry is also often divided according to the types of substances analyzed such as metals, oils and fats, foods, etc.

Inorganic Chemistry.—Mineral acids and their salts. Oxides, hydroxides, and hydrous oxides of metals.

Nonmetals and their compounds.

Iron and iron alloys.

Nonferrous metals and alloys.

Rare elements.

Radioactive elements.

Organic Chemistry.—Aliphatic and alicyclic compounds.

Aromatic and polynuclear hydrocarbons.

Alcohols, aldehydes, ketones, ethers, acids and acid derivatives.

Carbohydrates (sugars, starch, cellulose).

Organometallic compounds.

Organic compounds containing sulphur, halogens, phosphorus and other nonmetals.

Heterocyclic compounds (purines, quinolines, alkaloids).

Nonheterocyclic nitrogen compounds (nitro, diazo, amino derivatives, amino acids, proteins).

Miscellaneous organic compounds.

Biochemistry.—Physiological chemistry (animal).

Agricultural chemistry.

Foods, composition and processing.

Nutritional biochemistry.

Enzymes and microorganisms (fermentation, moulds, water, sewage, sanitation).

Pharmaceutical chemistry.

Toxicology.

See also CHEMICAL ANALYSIS; ELECTRO-CHEMISTRY; ELECTROMETALLURGY; METALLURGY; THERMO-CHEMISTRY.

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W. T. READ,

Chemical Adviser, General Staff, Department of the Army; Former Dean, School of Chemistry, Rutgers University.

CHEMITYPE, a term used in engraving to include various relief processes by which a drawing or impression from an engraved plate may be produced in relief to fit it for printing on an ordinary printing press. One of these, devised by C. Pül in 1843, depends on filling up the lines of the engraved zinc plate with some metal or alloy, and etching away the zinc.

CHEMNITZ, or **KEMNITZ**, Martin, German Protestant theologian: b. Treuenbrietzen, Brandenburg, Nov. 9, 1522; d. Brunswick, April 8, 1586. He received his early education at Magdeburg and Frankfurt on Oder, and later studied at Wittenberg. A follower of Melancthon, he wrote *Loci Theologici* (1591), a valuable commentary on Melancthon's system of dogmatics. Later he embraced the Lutheran doctrines and did much to spread them among Saxon and Swabian churches. In 1562 he attacked the

Jesuits in his *Theologiae Jesuitarum Praecipua Capita*, and, when the Council of Trent thought itself assailed in this work, he wrote *Examen Concilii Tridentini*, a work of great historical value. His *Corpus doctrinae Prutenicum*, drawn up with Joachim Morlin (1567) was also studied as a work of great authority.

CHEMNITZ, kēm'nīts, city, Germany, Circle of Saxony, at the base of the Erz Gebirge, and at the confluence of the Chemnitz River with three other streams 43 miles south-southeast of Leipzig. The city consists of an older inner town, almost circular in form, intersected by narrow streets, completely surrounded by modern suburbs. Among its numerous squares and public places are the Hauptmarkt, which contains the old Rathaus; the Neumarkt; the Königsplatz; with the Church of St. Peter and the Technical Schools. The city owns its water, gas, and electric works. Its educational institutions include a gymnasium, schools of agriculture, commerce, engineering and the various crafts. There is also a municipal library of over 35,000 volumes. Its manufactures and industries include: textiles, carpet, hosiery, machinery, chemicals, musical instruments, bicycles, automobiles, and electrical equipment.

Created a free imperial city as early as 1125, Chemnitz suffered much during the Thirty Years' War; but later in the century the introducing of cotton manufacturing revived its prosperity. Its growth before World War I was phenomenal. During World War II it was occupied by American forces in April 1945. Pop. (1939) 334,563; (1946 est.) 250,188.

CHEMOSH, kēm'mōsh, the national god of the Moabites, who were on that account called "the people of Chemosh" (Numbers 21:29; Jeremiah 48:46). In Judges 11:24, Chemosh is mentioned as the god of the Ammonites, but the whole narrative here applies to Moab, and not to Ammon. Milcom was the national deity of the Ammonites. The Moabite Stone was erected to commemorate victories achieved by the aid of Chemosh. In the inscription upon it Ashtar-Chemosh is mentioned, apparently a goddess associated with Chemosh. Human sacrifices seem to have been occasionally offered up to Chemosh (II Kings 3:26, 27). The worship of Chemosh was introduced among the Hebrews by Solomon, who "built an high place for Chemosh, the abomination of Moab, in the hill that is before Jerusalem" (I Kings 11:7). Some have identified Chemosh with the sun, others with Saturn, while still others have regarded him as a war-god. These identifications are valueless. Chemosh doubtless bore the same relation to the Moabites as did Yahwe to the Hebrews.

CHEMOSURGERY, kēm-ō-sūr'jēr-ī, the removal of tissue, such as malignant, gangrenous or infected tissue, after it has been fixed by chemical means. In the treatment of external cancer the purpose of the fixation *in situ* is to facilitate the systematic microscopic control of excision through the use of frozen sections.

FREDERIC E. MOHS, M.D.,
The University of Wisconsin-State of Wisconsin
General Hospital.

CHEMOTHERAPY, kēm-ō-thēr'a-pī, a term applied to the utilization of chemical agents

in combating disease. While serum, vaccine, and toxin therapies depend on stimulating the body's efforts to fight invading organisms, drugs used in chemotherapy directly attack the invaders and kill or inhibit them without serious damage to the body cells. Effective chemotherapeutic agents must be more toxic for the infecting organism than for the body. Mercury is such an agent, used in Europe to treat syphilis as early as 1500; other metal agents are arsenic, antimony and bismuth. Quinine, ipecac, the sulfa drugs (sulfonamides), and the antibiotics (q.v.) are also used in chemotherapy.

CHEMOTROPISM, kē-mōt'rō-pīsm, orientation (q.v.) by diffusing molecules, as where animals are mechanically attracted to their food by the sense of smell. This is positive chemotropism. Negative chemotropism consists in movements away from some reagent. Odoriferous particles are diffused or radiate from a center; chemotropism is thus analogous to heliotropism (q.v.).

CHEMULPO, chē-mūl'pō, Korea. See IR-CHON.

CHEMUNG, in geology a group of nearly 1,000 feet of Upper Devonian sandstones and shales named by James Hall in 1839 from the Chemung River in western New York. The rocks form the upper division of the Seneca Series, overlying the Genesee and Naples or Portage, and being succeeded by the Chautauquan Series; the corresponding time has been called the Chemungian Stage. The typical Chemung is of fossiliferous marine sands laid near shore, grading eastward into stream-laid red beds, part of the great delta that spread westward from mountains formed in western New England in the Acadian or Shickshockian orogeny. Westward, Chemungian rocks become finer-grained, more muddy, and pass into black bituminous shales of deeper water origin in Ohio. Shales near Rockford, Iowa, are noted for their abundant well-preserved fossils, particularly the brachiopods; similar forms are known from localities from Arizona to the Mackenzie River. See also DEVONIAN SYSTEM; GEOLOGY.

CHEMUNG, shē-mūng', Battle of the, in the Revolutionary War, Aug. 29, 1779, the decisive battle in Gen. John Sullivan's campaign to harry the Iroquois country. The Indians and their Tory allies made a stand in force at the Chemung River, about a mile southeast of Newtown (Elmira), N. Y.

CHEMURGY, kēm'ūr-jī, the name used for a comparatively new agricultural concept. It has to do with extending the industrial utilization of farm-grown raw materials through applications of science. More specifically, chemurgy is concerned with nonfood uses of farm crops, with new crops, and with utilization of farm wastes.

The term *chemurgy* is correctly used to describe this concept, rather than to define a science. Although often loosely called "the science of chemurgy," such use is inexact, since chemurgy involves not only chemistry, but also physics, agronomy, engineering, and still other sciences and arts. The term was coined the Egyptian root word *chem* and the Greek word *ergon*, with a literal meaning of "putting chemistry to work." Frequently the phrase

is "farm chemurgy," or putting chemistry (and allied sciences) to work for agriculture.

The idea had its origin in 1926 after a flood of legislative proposals had been offered to rescue agriculture from the surplus problems which had plagued farmers since the 1921 depression. Techniques of farm production appeared to be enlarging food output faster than population was growing. Foreign markets were not increasing. None of the political schemes promised permanent advancement of agricultural living standards.

In the face of these conditions note was taken of the rising chemical industry, in that decade making tremendous forward strides both in research and production. The possibility was suggested that since the human stomach was of limited elasticity, and since effective food demand could hardly be expected to consume all the potential production, nonfood industrial markets might be developed. The thought was advanced that if such markets could be adequately increased, an expanding and improving agriculture would still be possible and a strong rural population of independent, home-owning farmers might be maintained on the American land.

Farm raw materials, of course, had long before been used for inedible and nonwearable purposes. The Egyptians had included straw in making bricks. Cordage, charcoal, and ethyl alcohol were existing examples of what are now described as chemurgic products. However, the concept of an organized effort to develop industrial uses for farm materials had never been expressed until the appearance of an editorial in *Farm and Fireside*, October 1926. Since then the idea of chemurgy has become widely accepted, not only as a program for improving agricultural wealth and well-being in the United States and in conditions but as a means of advancing popular other nations.

An organization for promotion of the chemurgic idea was set up at Dearborn, Mich., in May 1935, following a conference of farmers, manufacturers, and scientists. Active since then, the National Farm Chemurgic Council has members in all states and in more than 30 foreign countries.

Three prime factors opened the way for chemurgy to emerge at this particular time. These were (1) organic chemistry; (2) plant genetics; and (3) power machinery.

Before the rise of organic chemistry at the close of the 19th century, farmers had little opportunity to market crops for other purposes than for food or for such fibers as could be processed mechanically or by hand. The organic chemical industry created huge demands for cellulose, proteins, starches, oils, sugar, and other natural chemical compounds available from plant life. Many of these compounds are produced by nature, through plant growth, more cheaply than they can be synthesized in the factories. The chemical industry thus became a wholly new outlet for agricultural raw materials, with the factory "stomach" supplementing the human stomach as a source of demand.

The science of plant genetics came into being just before the turn of the century. With this new knowledge plant breeders found themselves able to change the composition of farm crops, to improve their quality and yield, and to adapt them to specific purposes. As an example, soybean varieties have been bred with larger yields of oil. The sugar content of the sugar beet has been increased from 11 per cent to 17 per cent or more.

Geneticists are able to modify plants to make them more suitable as crops for industrial consumption.

The advent of internal combustion and electrical power machinery has lowered the cost of producing most crops. Consequently farmers are now able to grow crops as industrial raw materials and to offer them, with profit to themselves, at price levels competitive with alternative sources. Power machinery is playing an increasing part not only in the preparation and cultivation of the soil itself, and in harvesting the crops, but in their transportation, compressing, dehydration, maceration, and in various forms of partial processing and adaptation for industrial consumption.

Soybean.—Undoubtedly the soybean has become the most widely known chemurgic crop. First brought to the United States early in the 19th century, for more than 100 years it received little attention. By 1914 production amounted to 50,000 bushels and by 1920 had grown to 1,000,000 bushels. Research then rapidly developed better growing methods; mechanical methods for cultivation and harvest were improved, and as additional uses were found demand increased. By 1935 the crop reached 100,000,000 bushels; by 1950 this figure had been trebled.

The soybean has an oil content of around 20 per cent. The United States had long been deficient in production of vegetable oils, both edible and inedible. Soybean oil, found by chemists to possess exceptional versatility, was welcomed in industry as a complement to the insufficient supplies of flaxseed, cottonseed, palm, and other oils. At first soybean oil was regarded as ill suited for paints because it dried somewhat more slowly than flaxseed oil. This problem was overcome and substantial quantities are used in paint. Industrial products into which soybean oil enters include lacquer, enamel, resins, putty, calking compounds, linoleum, oilcloth, printing inks, and many others. Most of the soybean oil is consumed in cooking fats, margarine, and salad oils.

The meal which remains after the oil is extracted has a protein content of 53 per cent. Manufacturers of livestock feeds consume nearly the whole output. Refinement of the meal, however, has resulted in the extraction of various materials of higher value. One of these is lecithin, a phosphatide formerly obtained from the yolks of eggs. Soybean protein has had a large market in the manufacture of glue. Efforts to produce textile fibers from soybean protein have so far not been commercially successful. Plastic makers utilize soybean meal to some extent.

The consumption of soybeans for food and feed considerably exceeds their strictly chemurgic uses; the 15 per cent to 20 per cent of the crop demanded by nonfood industries has been a major factor in keeping the farm prices of the beans at more satisfactory levels than most other crops have maintained during the past two decades.

Corn.—United States farmers produce nearly 3 billion bushels of corn annually, and four fifths of it is utilized as feed on or near the farms where it grows. The 20 per cent which is sold for cash and enters industry finds more than 200 different end uses. Starch is the principal chemical component of corn. The grain also contains protein and oil. The textile industry, laundry operations, and papermaking are the three largest nonfood consumers of cornstarch. The quantity used in food is second to that consumed in textile manufacture.

Dextrin, made by further processing of starch, meets many kinds of needs for adhesives and binders, from postage stamps to battery compounds. Corn sugar and sirup serve for many sweetening purposes. Conversion of corn sugar into sorbitol, mainly used as a moistening agent, has become a large industry, with other sugar forms as byproducts. The oil from the corn germ is extracted for cooking and salad oils.

Industrial alcohol ranks among the important products of corn, especially since large quantities are required in the manufacture of synthetic rubber. A new and special variety of corn, known as waxey maize, is grown extensively for tapioca and adhesives. Its particular value arises from the differing molecular structure of its starch. The protein of corn, known as zein, has become an important industrial product. First widely used as a coating for paper to wrap grease- and oil-bearing materials, zein has become the source of a fiber which, under the trade name of Vicara, is blended with other fibers in numerous popular fabrics to which it lends desirable qualities.

Corn cobs.—Each bushel of corn yields about 14 pounds of cobs which formerly were a complete waste, undesirable even for soil conditioning. Before World War II ground cobs came into considerable demand for use in sandblast machines to polish delicate machine parts. Furfural, however, has become the main outlet for cobs.

Furfural was first produced commercially from oathulls, and still consumes practically all of these which are available. Requirements for furfural, however, have increased until oathulls are no longer in sufficient supply. Furfural found its first large uses in the refinement of lubricating oils and in resinous adhesives. Then it was found to be a desirable source for a nylon intermediate, and a large factory was erected to process it for that purpose. A large percentage of nylon fiber now derives from furfural.

Castor Bean.—Profitable new crops are sought by chemurgists. Out of some 300,000 species of plants known to botanists, less than 1 per cent are turned to human account. While not new, the castor bean has been grown in increasing acreages, mainly in the Southwest. The primary value lies in the oil which, when dehydrated, becomes a superior drying oil, and finds important uses as a lubricant and in brake fluids. It has special values because of its properties for withstanding extreme temperatures, both high and low.

Flax Straw.—Formerly straw was a farm waste which, like corn cobs, had no use on or off the farm and had to be disposed of. The straw is left after the seed has been threshed. Large quantities from Minnesota and California are now used to make cigarette paper. Formerly nearly all cigarette paper was made in France from old linen rags collected from central Europe. The American industry now meets all requirements. Paper for currency and for books such as Bibles also is made from flax straw.

Chlorophyll.—Chlorophyll has achieved various uses in the pharmaceutical trades. In the United States the extract is derived mainly from alfalfa, although broccoli and some other green plants are excellent sources.

Dehydration.—Markets for perishable fruits and vegetables have always been limited both in time and area, except as preservative methods have been developed. Canning does not materially

reduce weight or bulk; freezing requires refrigerated storage. New successes have been obtained in efforts to reduce perishable foods to powdered forms that may be conveniently packaged, will remain stable over long periods, and be palatable when reconstituted. An orange powder which, after standing months in a can at room temperatures, will make excellent orange juice, has been manufactured on a small scale after meeting military requirements. It promises to open markets where refrigeration is unavailable and at distances where oranges or canned juice cannot be shipped economically. Promising results also have been obtained with tomatoes. Experiments with other fruits and with potatoes, milk, and eggs, indicate that the new processes of dehydration will solve the former difficulties which made dried products unpopular because of unpalatability. If these efforts succeed they will help to stabilize farm prices of perishable items, extend their markets, and improve food supply and variety in several areas.

Research.—As the possibilities of chemurgic approaches to plant raw materials have become better understood, research has steadily pursued new developments. The United States government has established four large regional laboratories which are devoted to finding new uses for farm products and better processes for their utilization. Out of these laboratories have come such advances as frozen citrus juice concentrates, now widely used; the new orange powder previously mentioned; a process for deriving plasticizing materials from animal or vegetable fats, already in extensive commercial use; tanning materials from canaigre, a root which grows wild in the Southwest; and many improvements in processes using farm materials. A notable achievement was a practicable commercial process for making penicillin cheaply in quantity. Private industrial research into the chemurgic uses of farm materials has advanced even more extensively.

Chemurgic research in its continual examination of farm materials has taken into account the food needs of an enlarged population. Numerous processes have resulted in improvements in food manufacture and total supply.

Chemurgy has increased the number of uses and enlarged the markets for many farm products, and has helped to introduce new products into agriculture. It has found profitable uses for several farm wastes. It has created new markets, new jobs in processing products of the soil, new markets for industrial activity, and some new products for the American standard of living.

The National Farm Chemurgic Council, which serves as a continuous clearing house for chemurgic information, is located at 350 Fifth Avenue, New York 1, N. Y.

WHEELER McMILLEN,
Chairman of the Board, National Farm Chemurgic Council.

CHENAB, chē-nāb' (ancient ACESINES) river, in India, Kashmir, and West Pakistan, of the "five rivers" of the Punjab. Affluents are the Jhelum and the Ravi. It rises in the Himalayan ranges of Kashmir, and, entering West Punjab, Pakistan, near Sialkot, flows in a south western direction until it unites with the Sutlej River after a course of about 675 miles. The combined stream flows 50 miles further to Indus. The Chenab is of great importance to West Punjab because of its huge irrigation sy

tem: the Lower Chenab Canal (completed in 1892) and the Upper Chenab Canal (completed in 1912) irrigate some 2,500,000 acres of land in the Rechna Doab area.

CHENEDOLLE, shân-dô-lâ', Charles Julien Lioult de, French poet: b. Vire, Normandy, 1769; d. castle of Coisel, 1833. The French Revolution forced him to emigrate in 1791; later he served in the corps of the prince of Condé, and did not return to Paris until 1799. He was a friend of Mme. de Staël and a devoted admirer of René de Chateaubriand. His poetry, considered transitional between classicism and romanticism, is best known through *Le Génie de l'homme* (1807), *L'Esprit de Rivarol* (1810), and *Études poétiques* (1820). Charles A. Sainte-Beuve published in 1864 Chénedolle's complete works.

CHENERY, ché'nér-ī, Thomas, British publicist and Orientalist: b. Barbados, West Indies, 1826; d. London, England, Feb. 11, 1884. He was a correspondent for *The Times* of London in Istanbul from 1854 to 1856. After his return to London he remained on the staff of the paper as a writer and reviewer, until in 1877 he succeeded John T. Delane as editor. He is mainly remembered, however, for his scholarship in Semitic philology, as he mastered both Hebrew and Arabic. He was lord almoner's professor of Arabic at Oxford until 1877 and was one of the revisers of the Bible until shortly before his death.

CHENEY, ché'nī, Ednah Dow Littlehale, American abolitionist, woman suffragist, and author: b. Boston, Mass., June 27, 1824; d. Jamaica Plain, Mass., Nov. 19, 1904. She was an organizer in educational, religious, and social causes, and was particularly active in welfare work during the Civil War. Besides several novels, she wrote a biography of her husband, Seth Wells Cheney, one of Louisa May Alcott, and her own reminiscences.

CHENEY, John Vance, American poet and essayist: b. Groveland, N. Y., Dec. 29, 1848; d. San Diego, Calif., May 1, 1922. He was librarian of the San Francisco Public Library, 1887-1894, and of the Newberry Library in Chicago, 1894-1909. His volumes of verses include *Thisle-Drift* (1887) and *Poems* (1905); the finest of his critical essays were *The Golden Guess* (1892) and *That Dome in Air* (1895).

CHENEY, Seth Wells, American engraver and crayon artist: b. South Manchester, Conn., Nov. 26, 1810; d. there, Sept. 10, 1856. With his brother, John Wells (1801-1885), he became an engraver in Boston, Mass., in 1829; his finest plate was *Mother and Child*, engraved after the painting by Washington Allston. In 1833 he joined his brother in Paris where, while studying art, they supported themselves by engraving for American publishers. In 1838 the two brothers were associated with a third, Ward Cheney (1813-1876), in organizing a silk manufacturing company at South Manchester. From 1840 Seth had an art studio in Boston, where he proved highly successful in executing crayon portraits. He never attempted historical or genre subjects, and only rarely would he group two or more figures. His portrait studies included those of George Parker, William Cullen Bryant, and Charles Russell Lowell. Among popular crayon

drawings were *Rosalie* and *A Roman Girl*. In 1853 he married Ednah Dow Littlehale Cheney (q.v.).

CHENEY, Sheldon (Warren), American dramatic and art critic: b. Berkeley, Calif., June 29, 1886. After graduating from the University of California in 1908 he was associated with several periodicals as dramatic or art critic, and in 1916 founded the *Theatre Arts Magazine*, which he continued to edit until 1921. He spent the next few years in New York City, principally associated with Equity Players (The Actors' Theatre). Thereafter he devoted himself to lecturing and writing on modern art; opposed to academism in all fields of art, he maintained that creative vision and spiritual experience were the most practical elements in preparation for living. Most often reprinted of his numerous books was *A Primer of Modern Art* (1923), and *The Theatre: 3000 Years of Drama, Acting, and Stagecraft* (1929; revised and enlarged ed., 1952) became a standard history of the subject. Later books included the highly controversial *Expressionism in Art* (1934), *Art and the Machine* (1936), written with his wife Martha Candler Cheney, and *Men Who Have Walked with God* (1945).

CHENGTEH, chŭng'dŭ, or **JEHOL**, jě-hōl', city, China, capital of Jehol Province, in southwest Manchuria, 110 miles northeast of Peiping, to which it is connected by railroad. The gateway to Manchuria, Chengteh is enclosed by walls and is an important commercial center with a trade in wool, hides, and furs; silk weaving is carried on. The name Jehol is derived from Je Ho, "Hot River," a stream flowing nearby, the waters of which are said to be lukewarm. Chengteh has long been noted as the summer residence of Chinese emperors. The imperial palace, built around 1700, is located in a large walled park containing also several pavilions, a lake, a theater, and even lamaseries. The city was taken by the Japanese in 1932 and was restored to China in 1945. Pop. (1947 est.) 60,000.

CHENG TU, chŭng'dōō', city, China, capital of Szechwan Province and river port on the Min River, a tributary of the Yangtze, is located 170 miles northwest of Chungking. Its importance is mainly that of an agricultural trade center, as it lies in an exceedingly fertile plain, one of the most populous areas of China. An irrigation system, first devised in the 3d century B.C. and still in use, has added greatly to the natural fertility of the alluvial soil. Tea, tobacco, rice, wheat, potatoes, and sugar are raised in great quantities. Salt, produced in the vicinity, is also traded on a large scale, and cotton and silk textiles and matches are manufactured. One of the oldest cities of China, Chengtu is a flourishing cultural center, having two universities, a college of sciences, and other educational institutions. During World War II United States air bases were built nearby. Pop. (1948) 647,877.

CHENIER, shā-nyā', André Marie de, French poet: b. Istanbul, Turkey, Oct. 30, 1762; d. Paris, France, July 25, 1794. The son of Louis de Chénier (1722-1795), consul general in Istanbul and Morocco, André was secretary to the French ambassador in London from 1787 to 1790, and thereafter devoted himself to literary pursuits. Though at first an ardent supporter of

the French Revolution, he protested vigorously against the excesses of the Reign of Terror, helped prepare the defense of the king, and became an anti-Jacobin. He was arrested at a friend's house March 7, 1794, imprisoned and guillotined July 25, only two days before the fall of Maximilien de Robespierre. Although little known in his day, Chénier has long been regarded as one of the finest French poets of neoclassicism, his chief characteristics being purity of form combined with vigor of thought and of expression. He wrote idyls, elegies, odes (including one to Charlotte Corday), and dithyrambs. Of his love poems, the finest are those dedicated to Fanny. Among his best known compositions are *L'invention*, *Jeu de Paume*, *A la France*, and his *Bucoliques* and *Épîtres*. In prison he composed a beautiful elegy *La Jeune captive* and the *Iambes* which, owing to their spiritual affinity, are often likened to the poems of John Keats. His complete works were first published in Paris in 1819; several editions followed. Umberto Giordano's opera *Andrea Chénier* is based on the life of the poet.

CHENIER, Marie Joseph de, French dramatist and politician: b. Istanbul, Turkey, Feb. 11, 1764; d. Paris, France, Jan. 10, 1811. He was the younger brother of André Marie de Chénier. A whole-hearted Republican, he was a member of the National Convention, of the Jacobine Club, and of other revolutionary organizations. His tragedies—*Charles IX* (1789), *Henri VIII* (1791), *Caius Gracchus* (1792), *Fénelon* (1793), *Timoléon* (1794)—brought him fame and success more for their revolutionary tone than for their intrinsic value. The last tragedy, *Tibère*, however, is considered one of the best of the old classical school. Chénier also wrote the words for national songs: the *Chant du Départ* gained immense popularity. His works, collected in 8 volumes, appeared in Paris in 1824–1826.

CHENILLE, shě-nēl', a round fabric or trimming, made by uniting with two or more sets of warps, either by weaving or twisting, a fine filling or weft, which is allowed to project beyond the warps. This filling is cut at its outer edges and the fabric is then twisted, assuming a cylindrical shape with weft projecting radially from the central line of warps. Chenille may be of silk, worsted, wool, or cotton.

CHENNAULT, shě-nōlt', **Claire Lee**, United States Army Air Force officer: b. Commerce, Texas, Sept. 6, 1890. During World War I he served with the aviation section of the signal corps reserve, and in 1920 he was commissioned 1st lieutenant in the army's air service. He commanded a pursuit squadron in Hawaii from 1923 to 1926, and thereafter varied duties included teaching assignments at flying schools. By 1935 he had reached the temporary rank of major, and two years later, having resigned his commission, he went to China as adviser to the Chinese Air Force. In 1941 he organized a group of American volunteer fliers in China (the Flying Tigers) for service against the Japanese, and the next year, following entry of the United States into World War II, he was recalled to duty with the United States Army Air Force. With the rank of brigadier general he was given command of the China Air Task Force, and in 1943, promoted major general, he became com-

manding officer of the 14th United States Air Force. He relinquished his air command on July 15, 1945, and on October 31 retired from the air service. Returning to China in 1946, he organized an airline to carry relief to stricken areas of the country. In March 1948 he appeared before the House Foreign Affairs Committee urging United States military aid to Nationalist China. His autobiographical *Way of a Fighter* was published in 1949.

Consult Mims, S., *Chennault of the Flying Tigers* (Philadelphia 1943), and Ayling, K., *Old Leatherface of the Flying Tigers* (New York 1945).

CHENONCEAUX, shě-nōn-sō', village, France, in Indre-et-Loire Department, on the Cher River, 18 miles east-southeast of Tours. Its fame is due to the château, started in 1515 by Thomas Bohier, tax receiver under Francis I. It came into the hands of Henry II, who gave it to his mistress Diane de Poitiers, later dispossessed by Catherine de' Medici. The castle lies on an islet in the river, and in 1560 Philbert Delorme, celebrated French architect, built a wing spanning the river, about 200 feet wide at this point. A later owner, Madame Dupin, held here a literary salon. Pop. (1946) 220.

CHENOPODIACEAE, kē-nō-pō-dī-ā'sē, a family of herbaceous dicotyledons containing the garden vegetables beet, spinach, and Swiss chard as well as many common weeds. The family comprises about 102 genera and 1,400 species.

CHENOPODIUM, kē-nō-pō-dī-ūm, **GOOSEFOOT**, a genus of about 250 species of herbs belonging to the family Chenopodiaceae and distinguished by its usually mealy texture, its small green, apetalous, usually perfect flowers and its fruit consisting of a membranous coat containing a flat, shining black seed. The common name derives from the fancied resemblance of the leaves of some of its species to the webbed foot of a goose. The genus is primarily known for its weedy members, but a few species have positive economic value. *C. album* (lamb's-quarters or pigweed), a common, white-mealy weed of cultivated areas and waste ground. Young plants are commonly used as a pot herb. *C. amaranticolor*, large annual grown as an ornament for its bright violet-red top foliage and as a pot herb. *C. brodiaeoides* (American wormseed, Mexican teal), strong-smelling herb of tropical America yielding an oil that is used medicinally as a remedy for intestinal worms. *C. bonus-henricus* (Good Henry or wild spinach), a weed of churches and waste places in Europe and America which sometimes used as a pot herb. *C. botrys* (feather geranium, Jerusalem-oak), an annual grown for its strong, aromatic odor and its attractive flower appearance. *C. quinoa* (the quinoa of Peru, large perennial of Central America where it has been cultivated for centuries for its seeds which are extensively used to make soups and bread and, when fermented with millet, a mildly alcoholic drink.

DONALD G. HUTTLES

CHEOPS. See **KHUFU**.

CHEPSTOW, chěp'stō, urban district, Wiltshire, a river port in Monmouthshire, on the River, two miles above its junction with the Severn and 14 miles northeast of Newport. It has

aved and well-lighted streets. The principal edifices are the church, a fine specimen of Norman architecture, and the old castle, the ruins of which crown a lofty cliff overhanging the Wye. The ruins of Tintern Abbey are in the vicinity. There is a river and coastal trade. The beauty of the environs is an attraction to visitors. Both the town and the castle are referred to in *Domesday Book*. Pop. (1951) 5,285.

CHEQUE, the British usage for *check*. See **COMMERCIAL PAPER—Checks**.

CHEQUEEN, or **CHEQUIN**, more correctly **SEQUIN** (It. *seccino* from *secca*, the mint), an obsolete Italian gold coin which originated in Venice. See **SEQUIN**.

CHEQUERS, chĕk'ĕrz, an official country residence for British prime ministers, presented for that purpose by Sir Arthur Lee, K.C.B., M.P., in 1921. In 1917, the actual transfer of the property to the nation was not to have taken place during the lifetime of the owners; however, the plans were changed in 1920. The place is maintained in perpetuity as the official country residence of the prime minister for the time being, or, failing him, the full privileges of residence to be offered in turn to the chancellor of the exchequer, the foreign secretary, the American ambassador, the speaker and four other Cabinet ministers. Chequers stands in a sheltered hollow of the Chiltern Hills, about 36 miles from London. The history of the mansion goes back to the 12th century; it contains a number of Cromwell relics, a fine library and a valuable collection of manuscripts and autographs, among which are the letters of Napoleon, Washington, Charles I, Pitt, and Franklin. The area of the estate is about 1,000 acres, consisting of gardens, grounds, farms, woods and Coombe Hill. The hill, 852 feet high, was presented to the nation in 1913.

CHER, shâr, inland department, France, having on the north Loiret, east Nièvre, south Allier Creuse, west Indre and Loir-et-Cher, and formed of parts of Berry, Bourbonnais, Nivernais, and Orléanais. It is named from the river Cher, which traverses it southeast to northwest. Area, 2,200 square miles; capital, Bourges.

This department is included in the basin of the Loire, which forms the greater part of its eastern boundary. The climate is mild and pleasant. The place is generally flat but is diversified in the north by chains of inconsiderable hills. The soil is fertile but is fertile in the neighborhood of the Loire and Allier. Heath and sand prevail in the northern districts. The forests occupy about one-sixth of the area and furnish large quantities of fuel for the ironworks and timber for shipbuilding. Pastures are extensive and sheep very numerous. Grains, chestnuts, hemp, vegetables, and wines are among the important products. Beets, buckwheat, and flax are also grown. Minerals consist of iron, lithographic stones, building- and grind-stones, flint, marble, and potter's earth. The preparation and manufacture of iron is the principal branch of industry. The manufactured articles are metal ware, fine and common cloth, woolen goods, porcelain and earthenware, sacking, beet sugar, nut oil, paper and glass. The department is divided into two arrondissements, 29 cantons and 893 communes. Pop. (1946) 286,070.

CHER, a river of central France, rising in Auvergne in the department of Creuse and joining the Loire from the left near Tours; length, about 220 miles. It is navigable to Vierzon. This river gives name to the department of Cher.

CHERAGAS, shâ-râ-gâs', village, Algeria, in Alger Department, 6 miles west of Algiers. Table grapes are grown. Pop. (1948) 3,418.

CHERAN, châ-rân', town, Mexico, 23 miles north of Uruapan. Corn, sugar, tobacco and fruit are grown. Pop. (1944) 3,388.

CHERASCO, kâ-râs'kô (ancient CLARASCUM), commune, Italy, in Piedmont, in the province of Cuneo; near the confluence of the Stura di Demonte and Tanaro; 36 miles south of Turin. Its fortifications, once of great strength, were demolished by the French in 1801. It was repeatedly the object of contest between the French and Austrians in the wars of Italy, terminated in 1631 by a peace concluded here; and in 1796 Napoleon, by what is called the Armistice of Cherasco, obtained a free passage for his troops through the Sardinian states. The town is well built and has several silk mills. Founded in 1243, it has a castle, domed church, two triumphal arches, a gymnasium, and a technical school. It markets grain, wine, and truffles, and produces silk, flour, lumber, kilns, and cheese. Pop. 9,312.

CHERAW, chĕ'rô, town, South Carolina, in Chesterfield County; altitude 150 feet; 88 miles northeast of Columbia; on the Atlantic Coast Line and Seaboard Air Line railroads; on the Pee Dee River; and served by federal and state highways. Cotton textiles, lumber, and brick are the main manufactures. During the Civil War the Confederates maintained a supply depot here until captured by Gen. W. T. Sherman in March 1865. Some fine old residences and St. David's Episcopal Church and cemetery are interesting. Government is by mayor and council. Pop. (1940) 4,497; (1950) 4,836.

CHERBOURG, shâr'-bôorg, a seaport, France, in the department of Manche, 196 miles west-northwest of Paris, on the north coast of the peninsula of Cotentin, and nearly due south of Southampton. It has a strongly fortified arsenal, and consists of the old or civil town and the new or military (Port Militaire), the latter quite distinct from the former, and separated from it by the fortifications with which it is surrounded.

Cherbourg is a popular port for the embarkation and debarkation of transatlantic passengers, but it was its transformation into a great naval station that gave it its special importance. This was chiefly carried out under Napoleon I, Louis Philippe, and Napoleon III. The foremost port improvement was the breakwater, stretching across the entrance to the roadstead, which was formerly open to heavy seas from the north. It is more than two miles in length, of very massive construction, covers an area of 3,700 acres and consists of a longer (western) and a shorter (eastern) portion, forming at their junction a very obtuse angle pointing toward the north. There are a fort and lighthouse there at either end. The eastern entrance to the harbor, between the breakwater and the island of Pelée, is about 500 yards wide; the western entrance, between the breakwater and

Fort Chavagnac (on a rocky islet), is about 1,000 yards. Large ships of war enter through the western approach.

Cherbourg, an old Norman center, is probably of Roman origin, called in antiquity CAESARIS BURGUM or CORIALIUM. The English held possession of the place until about 1200 and again during the Hundred Years' War, when finally taken by the French in 1450. It was after leaving Cherbourg that an end was put to the career of the Confederate cruiser *Alabama*, when it was sunk by the Union cruiser *Kearsarge* (q.v.) in June 1864.

During World War II, on June 26/27, 1944, United States troops under Licut. Gen. Omar N. Bradley recaptured the city from the German occupation forces. Cherbourg suffered heavy damage during this engagement. Pop. (1946) 34,034.

CHERBULIEZ, shĕr-bŭ-lyă', **Charles Victor**, Swiss-French author: b. Geneva, Switzerland, July 19, 1829; d. Combs-la-Ville, Seine-et-Marne, France, July 1(2), 1899. Belonging to a family noted for literary attainments, he first achieved distinction as an art critic and political writer, publishing some of his essays under the pseudonym of G. Valbert. In 1864 he became one of the editors of the *Revue des Deux Mondes*, and was elected to the French Academy in 1881. His novels, equally successful in France and abroad, are characterized by a fine social and psychological analysis, with a marked bias for description of odd characters. Among these are *Le Roman d'une honnête femme* (1866); *L'Aventure de Ladislas Bolski* (1869); and *Samuel Brohl et Cie* (1877).

CHERBURY, LORD **Herbert of**. See **HERBERT**, **EDWARD**.

CHEREMKHOVO, chĭ-ryĕm'kŭ-vŭ, city, USSR, in southern Irkutsk Region (oblast) of the Russian SFSR, about 80 miles northwest of Irkutsk. It is located on the Trans-Siberian Railway, southwest of Lake Baikal. The center of a major coal basin, its development in the 20th century has been rapid. Apart from coal mining, there are chemical, synthetic rubber, machinery, brick, and processing industries. Pop. (1939) 65,907.

CHERIBON or **TJIREBON**, chĕr-ĭ-bŏn', town, Indonesia, on the north coast of Java, about 125 miles east-southeast of Djakarta. A seaport on the Java Sea, at the mouth of the Cheribon River, it has a good harbor that ships sugar cane, coffee, indigo, copra, rice, and teakwood. Industries include textiles, chemicals, cigars and cigarettes. Cheribon is the site of a Moslem shrine to Gunung Djati. It was the capital of a former sultanate, abolished by the British in 1815. Under the Dutch administration it was the center of a residency of that name. Pop. (1950) 51,732.

CHERIMOYA, chĕr-ĭ-moi'ă, the fruit of *Annona cherimola*, a plant of the family Annonaceae, native of South America and related to the custard-apple. It is a heart-shaped fruit with a scaly exterior and numerous seeds buried in a delicious pulp. Both flowers and fruit emit a pleasant fragrance. This fruit is now cultivated in various tropical regions.

CHERKASSY or **CHERKASI**, chĕr-kăs'sĭ, town, USSR, in the Ukrainian SSR, 90 miles

southeast of Kiev. It is situated near the right bank of the Dnieper, on the railway line connecting Chernigov and Odessa. Beet sugar, tobacco, and lumber are the main products of the surrounding region. Cherkassy was an important town of the Ukraine in the 15th century. It remained under Polish rule until the revolt of the Cossacks in 1648. Russia annexed it in 1795. During World War II German troops occupied it in 1941, but the Russians recaptured it, Dec. 14, 1943. Pop. (1939) 51,693.

CHERKESS AUTONOMOUS REGION, chĕr-kĕs', oblast, USSR, in the RSFSR and the southwestern Stavropol Territory of the western Caucasus. The capital is **CHERKESSK** (1939 pop. 28,646). Its inhabitants are largely of Circassian stock, who were for long under Turkish rule. The region achieved its present status in 1928. It covers approximately 1,500 square miles; pop. (1946 est.) 150,000.

CHERNIGOV, chĭr-nyĕ'gŭf, administrative region (oblast), USSR, in the Ukrainian SSR, along the Desna River, is predominantly agricultural, yielding flax, cereals, potatoes, hemo, sugar beets, tobacco, livestock, and dairy products. Natural resources include lumber and peat. The region covers approximately 12,200 square miles; pop. (1946 est.) 1,700,000.

CHERNIGOV, city, capital of Chernigov Region (oblast), about 85 miles northeast of Kiev. It is a river port on the Desna, a tributary of the Dnieper, and is on the railroad from Odessa to Byelorussia. Among its chief manufactures are flour, spirits, leather goods, footwear, textiles, and lumber.

One of Russia's oldest cities, it is mentioned as a flourishing center in the early 10th century. From that time stem the numerous tumuli in the city's vicinity. Its Byzantine Cathedral of the Saviour, destroyed in World War II, dates back to 1024. In the 11th and 12th centuries Chernigov was the capital of Syever'sk principality. It was burned by invading Mongols in 1239. In the 14th century it was annexed by Lithuania, then captured and held by the Poles until taken by Russia in 1686. During World War II it was occupied by the Germans in 1941, but recaptured by the Russians, Sept. 21, 1943. Pop. (1939) 67,356.

CHERNOVTSY, chĕr-nŏf'tsĭ (Ger. CZERNOWITZ; Rum. CERNAUTI), administrative region (oblast), USSR, in the Ukrainian SSR, is located in the western part of the Ukraine, north of Rumania and northwest of the Moldavian SSR. The Dniester River bounds it on the north and east. Annexed by the USSR from Rumania in 1940, the region was formed from northern Bucovina and northern Bessarabia. On the eastern lowlands, wheat and sunflowers are the main crops, and cattle is raised both for meat and dairy products. In the west, there are large herds of sheep in the Carpathian Mountains. These highlands are wooded, containing much valuable timber. The population is predominantly Ukrainian. The region covers approximately 3,200 square miles; pop. (1947 est.) 900,000.

CHERNOVTSY, city, capital of Chernovtsy Region (oblast) about 140 miles southeast of Lvov, along the south bank of the Pruth River and on the Lvov-Bucharest railroad. It is an im-

portant railway center. Industries include textile mills, food-processing plants, breweries, and machine shops. Chernovtsy is an Orthodox archbishopric and has a university, founded in 1875. The city is ancient and was in the Middle Ages under the rule of the Russian principality of Kiev. From the 14th to the 17th centuries Poland controlled it. Austria, which came to occupy it in 1774, later made it the capital of the separate crownland of Bucovina (1849-1919). Following World War I, Chernovtsy was granted to Rumania until forcibly annexed in 1940 by the USSR, which thus gained control of strategic Carpathian passes. Recaptured by Rumania during World War II in June 1941, it was taken by the Soviet armed forces in March 1944. Of its once large Jewish population, few survived German persecution. Pop. (1941) 87,000.

CHERNOZEM. See BLACK EARTH.

CHERNYSHEVSKI, chër-nî-shâf'skû-i, -skî, **Nikolai Gavrilovich**, Russian radical thinker and critic: b. Saratov, Russia, July 12, 1828; d. there, Oct. 17, 1889. A disciple of Vissarion Grigorievich Belinski, he was greatly influenced by the French pre-Marxist Socialists and the materialistic philosophy of Ludwig Feuerbach. His early political writings called for mild reforms in Czarist Russia, such as universal education, railway construction, and freeing of serfs. Later he bitterly assailed the onerous terms on which the serfs were actually freed. During the 1860's he became one of the first Russian revolutionary publicists to participate actively in anti-Czarist secret societies, and thus led the Russian Populist (*Narodniki*) reform movement from philosophy into action. As result of his association with the radical "Land and Freedom" campaign, he was arrested (1862). In prison he wrote the influential utopian novel, *What Is To Be Done?* (1863). Sentenced in 1864, he spent most of his remaining life in Siberian exile. Chernyshevski is held in high esteem in modern Russia and is often described as the greatest scholar and thinker among Russian pre-Communist radicals. Among his critical works are *The Aesthetic Relations of Art to Reality* (1855) and *Lessing, His Time, Life, and Activities* (1856). He also did translations from Adam Smith, John Stuart Mill, and the German historian Georg Weber.

CHEROKEE, chër-ô-kê' (possibly from Creek *tsiloki* "people of a different speech"). The Cherokee of the southern Appalachians were historically and culturally one of the most important and numerous Indian peoples of the United States. If we take the population of aboriginal America north of Mexico to be about a million, the Cherokee with some twenty thousand comprised a considerable part of the total. Linguistically they are of Iroquoian stock, but culturally they are to be classified with their neighbors in the southeast. Physically they were a mixture of the Algonquian-Iroquois dolichocephalic type and the Eastern and Southern brachycephals.

The Cherokee "Nation" was a confederacy of towns which according to dialects may be divided into three groups. The Eastern or Lower dialect (characterized by an "r" which takes the place of "l" in other dialects) was originally spoken in the towns situated on the headwaters of the Savannah River. The tribal name of this group, *Tsa rage*, was corrupted by the English into the

form we know, while the Spaniards, meeting the Central and Western towns, wrote the name *Chalague*. The Middle or Kituhwa dialect was spoken in the towns on the Tuckaseegee and the head of the Little Tennessee in the very heart of the Nation, and it is spoken by the North Carolina (*Qualla*) remnant today. The Western dialect was spoken in eastern Tennessee, northern Georgia, and on the Hiwassee and Cheowa rivers in North Carolina. It has been the literary dialect and is the language of the Western Band.

The total number of towns was probably 50 or more, but not infrequently locations were changed and their populations varied greatly according to the seasonal patterns. Although Echota or Itsati on the Little Tennessee was the most important town, it cannot be regarded as a true capital.

Cherokee life was laid in a setting of woods, stream valleys, and mountains. Numerous species of evergreens and hardwoods sheltered deer, bear, buffalo, elk, wolf, panther, wildcat, turkey, pheasant, and rattlesnake. There seems to have been no living creature that was not sought out for its meat, pelt, or feathers. Maize, beans, squash, and tobacco were the chief cultivated plants. The diet was augmented and diversified by the collecting of nuts, seeds, and berries.

The Cherokee economic organization, based on a pre-sedentary agriculture, was characterized by a division of work between the sexes. Routine cultivation was largely the province of women, although land-clearing and ground-breaking were common enterprises. The crafts of conservation pertaining to agriculture also were performed by women, who were the principal makers of baskets, mats, and sieves. These were made from cane which abounded on the banks of the lower rivers, and from splints of the oak. Here we find the northernmost extension of the double weave technique, but Cherokee basketry and pottery were inferior to similar products of the Gulf peoples. Smooth ware was common, but a distinctive pottery was characterized by paddle-stamped designs which are possibly to be related to basketry patterns. There is some sign of intrusion of effigy motives from the Mississippi area. Mortars and pestles were of wood rather than stone.

The usual variety of stone knives, axes, celts, awls, and heads was available, and these of course were augmented by tools and weapons of wood and cane. The latter, an important material, was commonly fashioned into knives.

The preparation of skins and clothes seems to have been the woman's task, although man indulged in the more gratuitous forms of ornamental fabrication. The invariable article of male attire was a deerskin breechclout augmented with skin robes, moccasins and leggings as the terrain and weather required. Women wore a short deerskin skirt as a basic garment. The use of feather cloaks was probably more ceremonial and decorative than utilitarian. Headbands of feathers, skins, or metal were common. Cloaks were "finger-woven" of the inner bark of the mulberry, and belts, garters, and the like were made from bison and opossum hair. Quill work was lacking or rare.

Tattooing was a universal practice, and the southern Indian wore identification tags and cuff jottings which J. R. Swanton calls bulletin boards. Both face and body were painted in preparation for ball games, war, and other social functions. Extravagant ear decorations were common, although the Cherokee did not join the Creek and Chickasaw in ornamenting the nose. Perhaps they practiced artificial head-flattening as did other southern tribes. The men wore their hair shaved or plucked to a roach or crest, but the women did not cut theirs.

Ancient dwellings were circular structures of logs, poles, and bark, frequently faced with earth. Ramsey speaks of a conical windowless town hovel 30 feet in diameter and 20 feet high which was used as a council hall and for ceremonials. "Within it were beds, made of cane, rather tastefully arranged around its circumference . . . [it] had a single entrance. . . . There was neither window nor chimney." There is some mention of a square house of poles, probably of

Iroquoian derivation. During the summer, meetings and social functions were held in open lounging pavilions, the more elaborate of which had porches. Corncribs, granaries, and storage houses for skins, weapons, and valuables were common in the more populous towns.

Transportation aids were rare. Rafts and canoes made from hollowed logs were paddled along less precarious river passages. Sometimes dogs were used to carry burdens.

Hunting, particularly of deer, was managed by stalking and surrounds. Fish were secured by spear, bow, dams, and poisoned pools. The simple hand drill was used to make fire.

Man was the hunter, seeking deer for both its meat and pelt. Hunting was done chiefly with the bow and arrow, although the blowgun, fashioned from cane, was used for small game.

Social organization was characterized by matrilinear totemic clans. There were seven exogamous clans: *Ani-Wa ya* (Wolf), *Ani-Kawi* (Deer), *Ani-Tsi skwa* (Bird), *Ani-Gilahi* (Long-haired People), *Ani-Gatagevi* (obscure), *Ani-Saha ni* (obscure, perhaps Blue People), *Ani-Wa di* (Paint).

Political organization was bifurcate in form. The "Red" hierarchy consisted of a high priest of war and his assistants, scouts, surgeons, and a number of "pretty women," clan ladies of high position and considerable influence, devoted to the prosecution of war. The "White" hierarchy was devoted to the maintenance of peace and had its separate organization. Some towns were classified as Red or White, and the latter were places of refuge.

The Cherokee had been established in the southern mountains at least two or three centuries before their first contacts with Western civilization during the incursions of Hernando de Soto in 1540, and later 16th century explorers. Their early contacts with the white settlements in the southern colonies were characteristically those of frontier trading, and exploratory and skirmishing relations. Among the important 18th century explorers who have left records of travels among the Cherokee are William Bartram, James Adair, and Henry Timberlake.

At the outset the chief effect of white settlement on Cherokee society was indirectly through the coastal tribes and through the displacement of neighboring populations. Trade in animal hides, especially deerskins, became a part of the Cherokee economy. The gun was the most important addition to tribal technology. In the middle of the 18th century a disastrous smallpox epidemic weakened the tribe. It was, therefore, ill-equipped for the serious conflicts with the Carolina settlers which broke out shortly thereafter.

Displacement of the Cherokee occurred with great rapidity, and the frontier moved forward well ahead of land settlement. Between 1721 and 1783 ten treaties were made with the colonies or states, and ten cessions were made; and between 1785 and 1835 twelve treaties were executed with the United States, and the Cherokee holdings east of the Mississippi were obliterated.

By the time of the American Revolution, Cherokee claims had so narrowed and the game supply had so declined, that a completely sedentary economy could be foreseen.

Following the Revolutionary War the Cherokee were well supplied with horses, cattle, hogs, poultry, peach trees, potatoes, and bees.

native arts of pottery and basketry were pursued, and dress and housing were little changed from the aboriginal habit although of course augmented by borrowed items. Traders begot a numerous offspring; persons of mixed blood intermarried, and an influential half-breed population grew up.

Moravian missionaries worked among the Cherokees during the latter part of the 18th century, but it was not until the close of the century that mission activity can be regarded to have made a heavy impact on Cherokee life.

Undoubtedly the most remarkable achievement in the Cherokee history occurred in the early 19th century with the invention of a syllabic alphabet by Sequoya or Sequoyah (George Guess). The syllabary was so constructed that it could be mastered in a matter of days, and thus the Cherokee became a literate people almost immediately after the alphabet's formal adoption by the tribe in 1821. Type was cast in the characters and in 1827 the first Indian press north of Mexico was established. On Feb. 21, 1828 the first number of the Cherokee *Phoenix*, printed both in English and in the Sequoya syllabary, was published in New Echota. As a consequence of these events the Cherokee achieved a closer integration which led to a constitutional form of government. Sequoya visited the Arkansas émigrés to instruct them in the alphabet.

Toward the close of the 18th century the first of the voluntary migrations occurred which continued until the forceable removal in 1838. Some emigrants went to Louisiana, several thousands settled north of the Arkansas, and some even penetrated Mexico.

Pressures against the Cherokee lands persisted through the first quarter of the 19th century, although the tribe vigorously resisted further encroachment. The discovery of gold in the Cherokee country, however, lent the final impetus to the pressure for displacement, and in 1828-1830 Georgia passed laws extinguishing the government of the Cherokee and distributing their land, just as it had done with the Creeks a little earlier. Although this was in direct violation of the numerous treaties between the tribe and the United States, and although the United States Supreme Court found in favor of the Cherokee, no effective protection intervened. On Dec. 29, 1835 a part of the tribe, under the leadership of Major Ridge, Elias Boudinot, and Stand Watie, signed a treaty ceding all tribal lands in exchange for other land in Indian territory and a sum of \$5,700,000. This group, which came to be known as the Treaty or Ridge Party, agreed that removal of the tribe would be accomplished within three years. This treaty was vigorously opposed by a majority of the tribe under the able, if sometimes ruthless, leadership of Chief John Ross, and the consequent cleavage weakened the tribe for more than half a century.

In 1838 the forceable removal to Indian Territory of the bulk of the tribe was accomplished by armed forces of the United States, after resistance and some loss of life. Many more died on the march, which was apparently poorly planned and badly administered, and a few hundred eluded the net and escaped into the Great Smoky Mountains in western North Carolina where their descendants, now called the Eastern Band, remain more than a century later.

Conflict immediately developed between the Treaty Party and the Ross Party. Hopes for a peaceful settlement were impaired by the weakness

and vacillation of the United States government, which recognized both groups by treaty. The uneasy truce was finally shattered by the assassination in 1839 of three members of the Treaty party, Major Ridge, his son John, and Elias Boudinot. Intermittent fighting then ensued for more than a decade.

Despite these destructive events a formal constitution providing for a head chief, a bicameral legislature and a judiciary was adopted in 1839 by a constitutional convention of about 2,000. The instrument was based on the constitution of 1727. With amendments it remained the organic law of the Nation until the end of tribal government at the beginning of the 20th century. Relations with the United States government were never well worked out, M. L. Wardell says, since the federal government considered the Indian problem a minor one. Certainly army garrisons in Indian Territory often did more harm than good and the Washington government showed little understanding of Cherokee problems.

In 1844 the *Cherokee Advocate* began publication under the editorship of W. P. Ross, a Princeton graduate and the nephew of John Ross. It was printed both in English and the Sequoyia syllabary for about ten years and began publication again after the Civil War, continuing into the 20th century.

The Civil War once more precipitated internecine conflict, for the Cherokee held several thousand slaves and their lands lay in an area of active combat. John Ross, still chief of the Nation, negotiated an advantageous treaty with the Confederacy. Hundreds of Cherokee fought on both sides during the conflict which devastated much of the Indian territory. Following the war the Cherokee were required to give lands to the freed slaves.

In 1891 the Cherokee Outlet (or Strip) was sold in response to demands of the United States. This did not for long relieve the pressures on the common tribal lands and in 1906 a comprehensive act provided for the dissolution of the tribal government and the final disposition of lands. By the middle of the 20th century there were more than 40,000 persons of varying degrees of Cherokee ancestry west of the Mississippi.

The remnant who escaped the Removal and fled to the highlands of western North Carolina, after many vicissitudes were able to cling to a small area which was made into a reservation. By the mid-20th century there were over 3,000 names on the rolls of this Eastern Band of whom about two thirds actually resided on the reservation. Few surviving Cherokee are full-blooded.

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LEONARD BROOM,
Chairman, Department of Anthropology and Sociology, University of California, Los Angeles.

CHEROKEE, city, Iowa, seat of Cherokee County, 48 miles northeast of Sioux City, on the Little Sioux River and the Illinois Central Railroad. The Sanford Historical Museum, the Sioux Valley Hospital, and a state hospital for

the insane are here. There are farm machinery works, creameries, and railroad repair shops. Settled in 1850, Cherokee was incorporated in 1873. Nearby is a huge glacial boulder known as Pilot Rock, a famous landmark. Pop. (1950) 7,705.

CHEROKEE, city, Oklahoma, county seat of Cherokee County. The city is a processing center for the wheat, alfalfa, corn, and sorghum of the district. Pop. (1950) 2,635.

CHEROKEE DAM, Tennessee, dam on Holston River, completed in 1942.

CHEROKEE NATION v. GEORGIA, a celebrated case in the Supreme Court of the United States concerning relations of the federal government with Indian tribes, decided in 1831. By terms of the Holston Treaty of 1791 the Cherokee Nation made a large cession of land in return for the government's guarantee of the territory retained by the Indians. Eleven years later, when Georgia ceded her western lands to the federal government, she obtained a promise that all Indians should be removed from her confines as soon as it could be done peaceably and on reasonable terms. This vague promise not having been fulfilled after more than a quarter of a century, the Georgia legislature by six successive acts—from Dec. 20, 1828 to Dec. 22, 1830—extended state laws and jurisdiction over the Cherokee lands, and ordered that they be distributed by lottery among Georgia citizens.

Early in 1829 the Cherokees appealed to President John Quincy Adams. He left the settlement to his successor, Andrew Jackson, a veteran Indian fighter whose sympathies were on the side of the Georgians. Despite all legal efforts to prevent them from carrying their case to the highest court, the Cherokee finally obtained a writ of error in a murder case from the Supreme Court, citing the state to appear. Georgia ignored the summons, as also a later one to respond to a request for an injunction against Georgia's interference with the Cherokee Nation's laws.

Chief Justice John Marshall and the majority of the Supreme Court decided on March 18, 1831 that the Cherokee were not a foreign nation in the meaning of the Constitution, since, for instance, an attempt by any other foreign nation to form a connection with them, or to trespass on their land, would be held an invasion of the rights or of the territory of the United States; that they were a domestic or dependent nation, in a state of pupillage, their relation to the United States being like that of a ward to its guardian; that their title to their land was only that of occupancy, the United States succeeding to it whenever their own possession lapsed; that their appeal lay to the president; and that the Supreme Court could not call out force to resist the extension of Georgia laws over territory claimed as its own.

A related case, *Worcester v. Georgia*, concerns the law restricting white men's residence in the Cherokee territory without Georgia's permission. Under this law, 11 missionaries were arrested and sentenced in September 1831 to four years' imprisonment. Nine accepted a pardon. However, the Rev. Dr. Samuel A. Worcester brought suit for a habeas corpus in the Supreme Court, which gave decision March 3, 1832. Here the court seemed to reverse itself, holding the state's acts violated treaties and

laws of the United States, and ordered the prisoner released as condemned on a void statute. The State refused to comply; but in place of waiting till the next term of the Supreme Court, to see if it would call on the United States authorities to enforce the decree, the prisoners made submission and were released. It is probable that Jackson's famous "John Marshall has made his decision—now let him enforce it," would have prevented them from regaining freedom till their term was up. Consult Hodge, F. W., *Handbook of American Indians* (Washington 1907).

CHEROKEE RIVER, the early name for the Tennessee River (q.v.).

CHERRY, the name of various species of trees and shrubs of the genus *Prunus*, family Rosaceae, closely related to the almond, peach, apricot and plum, thus comprising one of the most important groups of fruits—the drupaceous or stone fruits. Cherries are characterized by white flowers, usually in umbel-like fascicles, or in racemes, and subglobular, mostly red, yellow or black fruits, without bloom, and containing nearly globular, smooth stones. Few of the native species have attracted horticultural attention except for ornamental purposes, but some, especially, the wild black cherry (*P. serotina*), are highly prized as cabinet woods and for interior decorating.

The cultivated cherries have been derived almost wholly from two European species, *P. avium* and *P. cerasus*. The varieties of *P. avium* belong to three groups: hearts, heart-shaped, soft, light or dark, sweet fruits; bigarreaux; heart-shaped, firm, light or dark, sweet fruits; and dukes, light, somewhat acid fruits. Of these three groups the bigarreaux are the most important; they are largely grown in California and shipped to the Eastern markets. The hearts are somewhat grown for home use on both the Atlantic and Pacific coasts, in Europe and in Australia. The varieties of *P. cerasus* are divided into amarelle (light-colored) and morello (dark-colored) groups. The amarells are the leading acid cherries and most popular in the eastern United States, especially in western New York and Michigan, where they are largely canned and frozen. Most of them are used in pie making. The Montmorency is by far the leading acid or sour cherry variety. The leading sweet varieties (*P. avium*) are Lambert, Bing, Schmidt, Napoleon, and Windsor.

Besides these important species and their varieties, a few others have horticultural value, notably, *P. Mahaleb*, a hardy, rather small European species, which is used as a propagating stock; *P. pennsylvanica*, the pin, wild red, or bird cherry; *P. besseyi* and *P. pumilla*, the sand or dwarf cherries, which seem to grade into one another, the former producing sweet fruit, the latter acid, and which, being natives of the plains region, have been used by the hybridizers.

Cherries are propagated by budding upon either mazzard or mahaleb seedlings, the latter being in more general favor, especially in the West, because they are hardier, easier to grow, easier to bud and are freer from blight in the nursery. Sweet cherries succeed best upon well-drained light loams where the moisture is abundant but not excessive; sour kinds will stand

heavier but not wet land; neither prove profitable upon very rich soils. The ground should be thoroughly and deeply plowed and harrowed; the sweet kinds, which are large spreading trees, set 25 to 30 feet apart, and the sour kinds 15 to 20 feet. The land should be kept clean by frequent cultivation until midsummer, when a cover crop should be sown. This should be turned down the following spring, and the land treated as before. The principal fertilizer needed is nitrogen, which for most soils, should be applied in the late fall or early spring every year. The trees and fruits should be protected from attacks of insects and fungus diseases by systematic spraying.

The most serious insects of the cherry are the cherry aphid and the curculio. The cherry aphid is a small black insect that causes curling of the young leaves, and is controlled by spraying with nicotine sulphate. The plum curculio (see PLUM) is a small beetle whose larvae, or grubs, feed in the young fruits. It is controlled by lead arsenate spray.

The main fungus diseases of the cherry are brown rot of the fruit and leaf spot of the leaves. These are usually controlled with wettable sulphur sprays. For further information consult local state agricultural experiment station or Extension Division, United States Department of Agriculture.

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LEON HAVIS,
Plant Industry Station, Beltsville, Maryland

CHERRY, Wild, the bark of *Prunus serotina* collected in autumn. This is very extensively used in medicine as a vehicle basis, the syrup of the bark being used extensively in cough remedies. It contains a small amount of hydrocyanic acid.

CHERRY LAUREL (*laurocerasus officinalis*), a shrub closely allied to the common cherry, but having evergreen leaves, and is well known as an ornamental shrub.

CHERRY ORCHARD, The. Chekhov's realistic drama of Russian life, *The Cherry Orchard*, was first performed, with enormous success, at the Moscow Art Theatre in 1903, only a few months before the death of the author. Chekhov's literary activity was coincident with the deep depression that in the eighties of the last century spread over the "intelligentsia" of Russia, owing to the disappointing reaction following the war with Turkey. As a trained physician, Chekhov understands the diagnosis of this almost universal distemper and depicts it in his stories and plays. The title of *The Cherry Orchard* has a double meaning: It refers both to the actual orchard on the destruction of which hinges the plot of the play, and to Russia itself. The people of the play represent various types of Russian character. Madame Ranievskaya through weakness and mental inertia sacrifices her great estate and its chief glory, the famous cherry orchard; her daughter Vavara is alike inactive; Lopachin is the prosperous grandson of a former serf, into whose hands the estate passes;

the uncle Gayey is a type of the Russian who talks but who does nothing. The student Trofimov is a dreamer and idealist who sees what is the matter with Russia, and asserts that "in order to live in the present we must first redeem the past, and that can only be done by suffering, by strenuous, uninterrupted labor." With the faithful, unselfish old serf Fiers is contrasted the selfish young footman, Yasha.

Though the play ends with the prospect of a gloomy future for Madame Ranevskaya and her daughter, Trofimov sees the vision of a regenerated Russia; "Mankind goes on to the highest truth, and to the biggest happiness possible on earth, and I go in the very van." But the poor old serf Fiers is left behind forgotten and soon to die, and the sound of axes is heard in the cherry orchard. In its sincerity, its truth, its subtle characterization, and its idealism, *The Cherry Orchard* is representative of the best in modern Russian drama. It was first translated into English by George Calderon in 1912 and by Julius West in 1916.

NATHAN HASKELL DOLE.

CHERRY VALLEY, village, New York, in Otsego County, altitude 1,800 to 2,000 feet on the Delaware and Hudson Railroad, 54 miles west of Albany, and on state and federal highways. On Nov. 11, 1778 it was the scene of a massacre by Indians, Tories, and English, led by Joseph Brant and Walter Butler. The village has a "massacre monument," and many markers of historic spots.

It has good schools and churches, and a memorial library. The village was first settled in 1740. It is governed by a board of trustees, and owns its water system. Pop. (1940) 704, (1950) 90.

CHERRY VALLEY MASSACRE The Nov. 11, 1778), a surprise attack during the American Revolution on a frontier fort and surrounding settlement in the upper Susquehanna valley (Otsego County, N. Y.), led by the Tory Capt. Walter N. Butler, son of Col. John Butler, with Indian allies under Joseph Brant (q.v.).

General Lafayette, concerned over the exposed situation of Cherry Valley, had fortified it with a blockhouse the preceding spring; and Col. Peter Gansevoort, an experienced officer of high reputation, solicited the command. For some reason, however, it was given to Col. Ichabod Alden, a Massachusetts officer, not used to Indian warfare. During the summer the inhabitants lived in the fort and went warily; but by November they had returned to their dwellings. On the 8th, Colonel Alden received a message through a friendly Indian that at a great meeting of Tories and Indians at Tioga it was resolved to attack the place; and the people begged to be permitted to take refuge in the fort again. Alden ridiculed the report as an idle Indian rumor, assured them that he would guard against a surprise and sent out scouting parties. The party that should have beaten up Butler's went to sleep by a campfire on the night of the 9th, and awoke as prisoners of the enemy. Butler obtaining a company of his father's rangers, induced Brant, the great Mohawk chief, to join him with a few hundred of his Indians, picked up a band of Senecas and other straggling Indians and Tories as he went on, and with about 800 men approached Cherry Valley. Securing from the

prisoners, under threat of torture, all information as to the conditions there—as that the officers of the garrison lodged with families near the fort, instead of in it—the expedition camped about a mile southwest of the village on the night of the 10th. It snowed in the night, turning to rain in the morning. As the enemy approached under cover of the thick mist, an Indian fired on a stray settler and wounded him, but he escaped and warned the colonel, who thought the assailant only a straggling Indian, and paid no attention to the matter. The rangers stopped near the village to examine their guns, and the Indians sprang forward, the ferocious Senecas in advance, under their chief, Sayenqueraghta. In the massacre that ensued, 32 settlers, mostly women and children, the colonel and 15 soldiers, were slain; 30 to 40 prisoners were taken, also nearly all women and children; and the village was reduced to ashes. Most of the prisoners were released the next day, and sent back to effect an exchange for Butler's mother and younger brothers and sisters, in the power of the Americans.

CHERRYVALE, city, Kansas, in Montgomery County, altitude 837 feet, 150 miles southwest of Kansas City, on the Santa Fé and Saint Louis and San Francisco railroads. In a farming country with oil and mineral resources, the city manufactures flour, zinc oxide, garments, butter, oils and greases, farm equipment, brick and cement. It was settled in 1871 and incorporated as a town in 1879 and as a city in 1883. It is governed by a mayor and two commissioners. Pop. (1940) 3,185, (1950) 2,952.

CHERRYVILLE, chër'i-vîl, town, North Carolina, in Gaston County, 10 miles northeast of Shelby. Its industries are cotton milling, and machinery. Pop. (1950) 3,492.

CHERSKOGO RANGE, chër-skô'vû, mountain range, Soviet Russia, in the northeastern part of the Yakutsk Republic, Asia.

CHERSO. See CRES.

CHERSONESE, kûr'sô-nêz, The (Greek, peninsula). This name has been given to several peninsulas: (1) CHERSONESUS CIMBRICA, now Jutland, Denmark; (2) TAURICA (ancient CHERSONESUS), the peninsula formed by the Black Sea and the Sea of Azov—the Crimea; (3) THRACICA CHERSONESUS, the great peninsula in Thrace, now Gallipoli Peninsula; (4) CHERSONESUS AUREA or GOLDEN CHERSONESUS, in India beyond the Ganges, the Malay Peninsula.

CHERT, a cryptocrystalline (not visibly crystalline) variety of quartz closely related to flint, but less translucent and having a more splintery fracture. In geology the term is applied to a considerable range of siliceous rocks, from the impure flints largely formed from the siliceous remains of organisms, sponges and diatoms, found in limestones and other stratified rocks, to the jaspered quartz formed by the alteration of limestones or limy sandstones.

CHERTSEY, chûrt'sî, town, England, in the county of Surrey, 22½ miles southwest of London, on the London and Southwestern Railway, is pleasantly situated on the right bank of the Thames, over which there is

an 18th-century bridge. Charles James Fox lived nearby for a time and Abraham Cowley spent here the last years of his life. Of the great Benedictine monastery, founded in 666, only the ground plan is now traceable; the Abbey fell into decay in the 17th century. Noted in the Middle Ages for its fairs, Chertsey is a busy market town for garden produce shipped to London; it has manufactures of electrical equipment. Pop. (1951) 31,029.

CHERUB, chër'üb (pl. CHERUBIM), one of the order of heavenly beings (see ANGELS) which in the angelic hierarchy are next to the seraphim. Originally, in Mesopotamia, the word referred to a winged sphinx with human head and animal body, placed at the entrance of sanctuaries and palaces as divine intercessors and guardians. Their use in Hebrew religion came from that of the Canaanites. (See II Samuel 22:11, I Kings 6:23, I Chronicles 28:18, Ezekiel 28:14, Psalms 18:10, Exodus 25:20, where they now symbolize the power and majesty of Israel's God, Yahweh.) In the New Testament (Revelation 4:6) the four "Living Creatures" are derived from later Jewish apocalyptic literature, all of which derived this feature from Ezekiel 1:4-28.

Consult Charles, R. H., *Commentary on the Revelation of St. John*, vol. 1, pp. 118-123 (New York 1920).

FREDERICK C. GRANT,
Union Theological Seminary.

CHERUBINI, kār'ōō-bē'nē, **Maria Luigi Carlo Zenobio Salvatore**, Italian composer; b. Florence, Sept. 14, 1760; d. Paris, March 15, 1842. At 13 he had written a mass and other sacred music, and between 1780 and 1784 he wrote 7 operas, which were performed in various cities of Italy. In 1784 he was invited to London, where he wrote for the King's Theatre *La Finta Principessa* (1785), which was well received, and the less-successful *Giulio Sabino* (1786). He received there the title of court composer. In 1786 he moved to Paris. The opera *Ifigenia in Aulide* was first performed in Turin in 1788, and that same year the Paris Opera staged *Démophoon*. His operas—*Lodoiska* (1791), *Elisa* (1794), *Médée* (1797)—succeeded one another at a fast pace, showing progress toward broader forms and more complex orchestration. The musical comedy *Les deux Journées*, first performed in Paris in 1800, gained great popularity in Germany and Austria under the title *Der Wasserträger*. In 1795 Cherubini was named inspector of the Paris Conservatoire, a poor post for his talents; this was due to Napoleon's dislike for him because of a sarcastic remark on the emperor Cherubini had once made. During his sojourn in Vienna, where he produced *Faniska* (1806), he met Ludwig van Beethoven, who greatly admired his work. After his return to Paris, Cherubini resolved to give up music and retired to the castle of the prince of Chimay. His friends later convinced him to produce a composition for a local religious festival: he wrote the great *Mass in F* for three voices and orchestra. From now on he devoted more and more of his time to liturgical compositions, although he did not give up opera entirely—his last one, *Ali Baba*, being produced in 1833. His religious works include 10 masses, the great *Requiem in D Minor*, a Te Deum, litanies, etc. He also excelled in chamber music: his six string quartets and his quintet are still performed. In 1822

Cherubini was made permanent director of the Paris Conservatoire. His *Treatise on Counterpoint and Fugue* became a classic and was translated in several languages.

Consult Bellasis, E., *Cherubini: Memorials Illustrative of His Life* (London 1874); Crowest, F. I., *Cherubini* (London 1890).

CHERUEL, shā'rū-ël, **Pierre Adolphe**, French historian; b. Rouen, Jan. 17, 1809; d. Paris, May 1, 1891. He taught at Rouen and in Paris, and later was rector of the academy at Strasbourg, then at Poitiers. Of interest are his *Dictionnaire historique des institutions, mœurs et costumes de la France* (1855), and his three essays on the Duc de Saint Simon. On Mazarin whose letters he also published, he wrote *Histoire de France pendant la minorité de Louis XII* (1880) and *Histoire de France sous le ministère de Mazarin* (1883).

CHERUSCI, kê-rūs'i, people of Germany mentioned in Caesar's *De bello gallico* as living next to the Suevi, between the Elbe and Weser rivers. As one of the strongest and most numerous of Germanic tribes, they played a prominent role in the resistance against Rome. They were submitted by Drusus and Tiberius, but continued to exert a sort of hegemony over the smaller Germanic tribes. In the general uprising against Rome a few years later their great leader Arminius (q.v.) won a decisive victory over Varus and his legions in the Teutoburg Forest (9 A.D.). In 16 A.D. however, Germanicus indicated Varus' defeat. Internecine warfare and the struggle against Rome and the neighboring tribes greatly weakened the Cherusci, who had to yield their prominent position to the Chatti. In Tacitus' times they had already lost their importance.

CHERVEN BRYAG, chër'ven bri-äk', city, Bulgaria, in Pleven district, 5 miles north-north-west of Lukovit, on the Panega River. The city is an agricultural center and rail junction. Pop. (1946) 5,268.

CHERVIL, name applied to two kinds of herbs grown in the vegetable garden, both belonging to the Umbelliferae or parsley family, native of Europe. Salad chervil (*Anthriscus cerefolium*) is an annual herb, of simple culture, the sweet-scented leaves used like parsley for garnishing and for flavoring soups and stews. Also called curled chervil, it is chiefly grown as a spring or fall crop, since it does not thrive well during the summer. It does best in rich, well prepared soil. Similar to curled parsley but of more delicate texture, its leaves bright rich green, finely divided and curled, chervil has a pungent, aromatic flavor. The black seeds produce seedlings two to four weeks after planting, and the leaves are ready for use in eight to ten weeks after the seed is sown. Plants produce a rosette four to five inches tall, with a spread of 10 to 12 inches, and later a branched flowering stem, commonly 15 to 18 inches tall. Turnip-rooted or tuberous chervil (*Chaerophyllum bulbosum*) is a hardy biennial, producing carrot-like small gray or blackish edible roots, eaten either like beets, or used as flavoring for soups and stews. Since its seeds lose their vitality very quickly, they should be sown in the autumn (as soon as the seeds are ripe), or else stratified until spring. The cultivation resembles that of carrots.

CHESAPEAKE AND DELAWARE CANAL, connecting Chesapeake and Delaware bays. Its overall length, including approaches, is 19.1 miles, although the actual distance from bridge to bridge is 14 miles. See **CANALS**.

CHESAPEAKE AND LEOPARD, Affair of the, June 22, 1807. *Chesapeake* was a 38 gun frigate destined to relieve the *Constitution* in the Mediterranean. Capt. James Barron was to go out in her as commander of the Mediterranean squadron. She had been refitted at the Washington Navy Yard, and made final preparations at Norfolk, reporting ready for service on June 19. On the 22d she got under way, but expecting no attack from powers at peace with this country, was in no shape for immediate action, and being four months behind time, could not wait. The gun deck was obstructed with various lumber, sick seamen were lying on the upper deck, the cables were not stowed away, the powder horns were not filled and the crew was raw and not exercised at the guns. At this time, in the heart of the Napoleonic wars, the high wages and relatively safe employ of the American merchant and even naval service, with the rights of American citizenship immediately obtained, raised the normal rate of desertion from the British Navy so much that its officers were much embarrassed and greatly incensed; and Great Britain claimed, as for many years afterward, the right of searching neutrals for deserters and contraband. At the same time, her press gangs crimped for service any strays who could be caught, of any nationality, and rarely gave any redress. Early in 1807 a British fleet lay off Norfolk watching to intercept some French frigates in the Chesapeake; and a boat's crew deserted bodily and escaped to Norfolk. The captain was told that they had enlisted on the *Chesapeake*—which was true of only one, and he under an assumed name; and meeting the latter and another deserter in the streets of Norfolk, was defied. Another vessel, the *Melampus*, reported three deserters gone to the *Chesapeake*, but it was proved that they were native Americans illegally pressed. Admiral Berkeley, at Halifax, on complaint of his officers, ordered any of his vessels to overhaul and search the *Chesapeake* on meeting her outside the United States jurisdiction. The order was carried out by the 52-gun flagship, *Leopard*. Captain Humphreys, after consulting with the local commandant at Lynnhaven, followed the *Chesapeake* out beyond Cape Henry, hailed her, and sent a boat with a copy of Berkeley's order. Barron, who believed that he had no deserters aboard except the *Melampus*, which were not really such, honestly denied having any, but refused the right to search; the messenger lieutenant at once left and within five minutes the *Leopard* came closer, and Humphreys announced that he should carry out his orders. Barron at once called his men to quarters, and did everything that skill, coolness and courage could do to prepare for action, but the *Leopard* almost at once poured one whole broadside into the *Chesapeake*, and then two more in rapid succession, without the possibility of her opponent replying. Three of the latter's men were killed, Barron and 17 others wounded, and it was certain that the vessel would be sunk in a short time if the fire kept up, and Barron, to stop a useless

massacre, struck his flag. The one English deserter was hunted out and hanged, the three Americans taken and imprisoned. The mass of the country was on fire with indignation; the extreme Federalists at first justified the English course, but were compelled by public feeling to exhibit some patriotism. Even Jefferson, whose unwise course had brought on the catastrophe, interdicted British cruisers from American ports, and demanded disavowal and reparation from Great Britain, which were not given; but he did nothing to prevent the recurrence of such outrages. The unfortunate Barron, who had behaved like a brave man and good officer, and whose instructions had bound him to do nothing to bring on collisions, was made the scapegoat of the popular fury. His own captain screened himself by accusing him, and a court-martial on board his own vessel from Jan. 4-8, 1808, Capt. John Rodgers president, after acquitting him of all blame in every respect but one, found him guilty in not preparing for action as soon as he read Admiral Berkeley's order, and sentenced him to five years' suspension without pay or emoluments. The gross injustice of this is now admitted. One of the judges was Stephen Decatur (q.v.), who never ceased reflecting on Barron till the latter challenged and killed him.

CHESAPEAKE AND OHIO RAILWAY COMPANY, The, a railroad which had its origin in the charter of a company by the legislature of Virginia on Feb. 18, 1836, to build through the county of Louisa, Va., to the eastern base of the southwest mountains in Virginia, and was styled The Louisa Railroad Company. Under this title construction was completed from Hanover Junction (now Doswell, Va.) to Shadwell, Va., 64.50 miles (1836-1850). Operation was by the Richmond, Fredericksburg and Potomac Railroad Company until 1847. As of Feb. 2, 1850 the name of the Louisa road was changed to the Virginia Central Railroad Company. Construction was completed into Richmond, Va., from Hanover Junction in 1851. Westward the road was extended and operated in short sections reaching Jackson River, approximately two miles west of the present Clifton Forge, Va., by 1857; with an approximate mileage of 292 miles. Of this mileage 16.81 miles through the Blue Ridge Mountains was built by the State of Virginia and incorporated in 1849 as The Blue Ridge Railroad Company. Virginia Central and Chesapeake and Ohio operated this property until it was acquired by Chesapeake and Ohio in 1870. The Virginia Central was built to Covington, Va., in 1868.

In 1853, the state authorized the construction of the Covington and Ohio Railroad, from Covington, Va., to the Ohio River. After about \$3,000,000 was expended with no line completed, work was stopped by the War Between the States. When the war ended, the state having been dismembered, Virginia and West Virginia united in efforts which resulted in combining the Virginia Central and the Covington and Ohio Railroad Company in 1868 under the corporate name of Chesapeake and Ohio Railroad Company. Completion of the road westward to Huntington, W. Va., on the Ohio River, was achieved in 1873. In 1878 the road was sold under foreclosure and reorganized as The Chesapeake and Ohio Railway Company.

Under legislative authority, the road was extended from Richmond to Newport News, Va., operating as of 1882, and to Fort Monroe in 1890. In the meantime it had been built from Huntington to the Big Sandy River, the western boundary of West Virginia, where it established connection with the Elizabethtown, Lexington and Big Sandy Railroad Company in October 1880, opening up through service to Lexington, Cincinnati and the west and south. In 1888 the road was again reorganized, forthwith securing control, through stock ownership of the Maysville and Big Sandy Railroad Company and the newly built bridge at Cincinnati, of operation into Cincinnati, with an approximate mileage from Newport News to Cincinnati of 664 miles.

In 1892, the Elizabethtown, Lexington and Big Sandy Railroad Company, extending to Lexington, Ky., was acquired, and in 1895 through service to Louisville, Ky., was established by an agreement with the Louisville and Nashville for the joint use of its line from Lexington to Louisville.

The Richmond and Alleghany Railway Company, located in the James River Valley, operating the 230 miles between Richmond and Clifton Forge, Va., was conveyed to Chesapeake and Ohio in January 1890, thereby affording a low-grade route to tidewater for the company's heavy coal tonnage. Through acquisition of the Richmond and Alleghany and allied canal properties Chesapeake and Ohio established its original antecedent as The James River Company (canal and turnpike), incorporated 1785, with George Washington as first, though inactive, president.

Chesapeake and Ohio's entrance into Washington, D.C., was secured in 1891 under lease and trackage agreements for the joint use of tracks of the Virginia Midland Railway Company (now Southern Railway Company) and the Washington Southern Railway Company. (A number of subsidiary lines and branches had been built or acquired penetrating mineral and timber regions. Among these were the Big Sandy in Kentucky; the Guyandot Valley; Coal River; Cabin Creek; Paint Creek; Gauley; Loup Creek; Piney Creek; the Greenbrier, in West Virginia and branches in Virginia.)

In 1910 the Chicago, Cincinnati and Louisville Railway Company was purchased under foreclosure proceedings and reorganized as The Chesapeake and Ohio Railway Company of Indiana, the property of the latter being acquired in 1934. This afforded an outlet to Chicago and Lake Michigan.

To obtain a connecting link with the Hocking Valley Railway Company, controlled through stock ownership as of 1910, the Chesapeake and Ohio Northern Railway Company caused to be constructed 30 miles between Limeville, Ky., and Waverly, Ohio, in 1917, and the Chesapeake and Hocking Railway was constructed in 1927, a distance of 63 miles between Greggs and Valley Crossing, Ohio. The properties of these two companies were acquired in 1921 and 1930, with the Hocking Valley and Chesapeake and Ohio being merged as of 1930, thereby giving the Chesapeake and Ohio the much desired main line operation to Toledo and the Great Lakes.

Stock control of the Pere Marquette (PM) was acquired in 1929. The plan of consolidation announced by the Interstate Commerce Commission in 1929, and modified in 1932, provided for a Chesapeake and Ohio-Nickel Plate System.

This was delayed. Robert R. Young, Chairman of Chesapeake and Ohio's Board of Directors as of 1942, continued the plans for a C&O, NKP and PM merger. With NKP stockholders and directors in control as opposed, NKP was dropped and in 1946 C&O and PM signed an agreement of merger. This was consummated June 6, 1947. The two lines are identified as the Chesapeake District and the Pere Marquette District of The Chesapeake and Ohio Railway Company.

The eastern termini of the Chesapeake and Ohio are Washington, D.C., Newport News, and (by ferry transfer) Norfolk, Va. From these places it extends westward, passing through the agricultural, and historical tidewater and Piedmont regions, crossing the Blue Ridge Mountains and the Shenandoah Valley of Virginia, thence through the iron ore regions, across the Alleghany Mountains to and through the coal and timber fields of West Virginia to the Ohio River, at Huntington. One of its lines continues along the Ohio River within the north boundary line of Kentucky to Cincinnati, Ohio, and thence across Indiana to Chicago; another extends from Ashland, Ky., through the Blue Grass region to Louisville, Ky., and another northward to Lake Erie at Toledo. From Toledo over the Pere Marquette District the system serves Detroit, Flint, Lansing, Saginaw, Grand Rapids, Chicago, Milwaukee; two other Lake Michigan ports in Wisconsin through its fleet of modern car ferries; a prosperous and industrial territory in Ontario; and one in the vicinity of Buffalo, N. Y.

The Pere Marquette Railway Company was a combination of something over forty individual Michigan railroad companies which, prior to 1900, had been merged into three small systems—the Flint and Pere Marquette Railroad Company, the Chicago and West Michigan Railroad Company, and the Detroit, Grand Rapids and Western Railroad Company. In 1903 this mileage was increased by the acquisition of The Lake Erie and the Detroit River Railroad Company, in Canada, a line which runs easterly from Windsor and is reached by car ferry operation over the Detroit River.

The Flint and Pere Marquette Railroad Company was probably the pioneer of all of the companies, the consolidation of which went to make up the Pere Marquette Railway Company. That company filed its articles of association in 1857 and operations began in 1862. The 170 miles from Flint to Pere Marquette (now Ludington) required 17 years to build. Michigan was then timberland, with construction through heavily timbered forests, with rivers to cross and grades to subdue. Most of the 40-odd railroads later merged with Pere Marquette were built during the big timber days.

In 1890 the Flint and Pere Marquette effected an entrance into Detroit. Prior to 1897 freight carried to Ludington, destined to Wisconsin points, was unloaded from the freight cars and transferred to boats for transportation across Lake Michigan. In 1897 a car ferry was constructed which was capable of carrying 30 small freight cars across the lake, and so, in effect, the rails of the Flint and Pere Marquette were extended across Lake Michigan. From this beginning came the modern car ferry service of the Pere Marquette District today. An airplane

view of the Marquette District would show two lines of railroad spanning Michigan from west to east: one line running from Ludington on the west coast, through Saginaw and Detroit to the Toledo Gateway, with a fork from Saginaw to Port Huron on the east coast; the other line from Chicago, in the State of Illinois, through Grand Rapids to Detroit, with a line branching out from Grand Rapids and running north to Petoskey near the Strait of Mackinac, and one north to Saginaw. The Canadian line, through the medium of car ferries operating on St. Clair and Detroit rivers, not only lengthens the haul to Buffalo but with car ferry operations on Lake Michigan, provides a short route between the northwest and the Atlantic seaboard. See also NEW YORK, CHICAGO AND SAINT LOUIS RAILROAD COMPANY (NICKEL PLATE ROAD), THE.

WALTER J. TUOHY,
President, The Chesapeake and Ohio Railway Company

CHESAPEAKE AND SHANNON, Battle of, June 1, 1813. In the War of 1812, the former vessel (See CHESAPEAKE and LEOPARD, AFFAIR OF THE), cruised to no purpose from December 1812 till April 1813, and arrived at Boston, April 9. Her captain, Evans, left her on account of ill-health, and about the middle of May was replaced by Capt. James Lawrence, famous for the brilliant victory of the *Hornet* over the *Peacock*. He accepted against his will; nearly all the officers and crew were new, and the latter second-rate, totally untrained and glibly over questions of prize money. On May 25 Captain Broke of the *Shannon*, lying outside, sent away his consort, the *Tenedos*, to have a fair chance to fight the *Chesapeake* alone, and repeatedly urged Lawrence to arrange a duel between the ships. In theory they were evenly matched; they were of almost exactly the same length; the *Chesapeake* now carried 50 guns, the *Shannon* 52; the *Chesapeake* had 379 officers and crew against the *Shannon's* 330, but the latter had been trained for seven years under Broke himself, kept in constant artillery and other practice, and was a thoroughly disciplined fighting machine, men used to each other and the officers. On June 1, however, Lawrence sailed out to meet his enemy, and at 5.30 p.m. they engaged. After a couple of broadsides, the *Shannon's* shot cut the *Chesapeake's* stays, and the latter drifted helplessly stern foremost toward her adversary. There was no salvation but to make sail forward or to board, and both were impossible. The *Shannon's* broadsides and the musketry fire from her tops swept the *Chesapeake* diagonally from stern to stern, without the latter being able to fire a shot in reply, beating in the stern ports and killing or wounding every man on the quarter-deck and the after part, including the men at the wheel. Just before the vessels struck, Lawrence ordered up his boarding party; but almost at the same instant he fell mortally wounded by a musket ball, and was carried below. Not a living person was on the quarter-deck, and Broke, with 50 boarders, rushed on board unresisted just as the vessels parted. So fierce was the resistance from that 30 or so of the American crew who had rallied at the fore-castle, that 37 of the boarding party were killed or wounded, including Broke himself. The *Chesapeake* lost 61 killed and 85 wounded; the *Shannon* 33 killed and 50 wounded. The former was

towed into Halifax as a prize, turned into a British war vessel and in 1820 was broken up.

CHESAPEAKE BAY, in Maryland and Virginia, and dividing the former state into two parts, is the largest inlet on the Atlantic coast of the United States, being 200 miles long and from 4 to 40 miles wide. Its entrance, 12 miles wide, has on the north Cape Charles, and on the south Cape Henry, both promontories being in Virginia. The bay has numerous arms, which receive many navigable rivers such as the Susquehanna on the north, the Potomac, Rappahannock and York on the west, and the James on the southwest. Extensive oyster beds are to be found in this bay; and game fowl are plentiful.

CHESAPEAKE BAY DOG. See Dog.

CHESELDEN, chës'el-dën, William, English surgeon and anatomist: b. Somerby, Leicestershire, Oct. 19, 1688; d. Bath, April 10, 1752. At the age of 22 he began to give lectures on anatomy, and in 1712 he was chosen F.R.S. In 1713 he published a treatise on the *Anatomy of the Human Body*, long a favorite manual of the science. He continued to read his lectures for more than 20 years, during which he gradually rose to the head of his profession. In 1723 he published a *Treatise on the High Operation for the Stone*; in 1727 was appointed surgeon to Queen Caroline. One of the greatest British surgeons, he once performed his celebrated operation for the stone in 54 seconds. His *Osteographia* was published in 1733.

CHESHIRE, or **CHESTER**, England, a maritime county, bounded by seven other counties in England and Wales, by the estuaries of the Dee and Mersey and by the Irish Sea. Its area is 1,026 square miles, of which the greater part is under cultivation. The surface is generally level, the soil mostly a rich reddish loam variously clayey or sandy. There is some of the finest pasture land in England; and cheese, the main product of the Cheshire farmer, is made in great quantities. Extensive tracts of land are cultivated as market gardens, the produce being sent to Liverpool, Manchester and other cities. Minerals abound, especially rock salt and coal, which are extensively worked. Cotton manufacture is carried on at Stockport, Stalybridge and in the northeastern district, shipbuilding at Birkenhead and other places. There are numerous railroad lines and a splendid system of canals, among them the famous Manchester Ship Canal. The various divisions of the county return nine members to the House of Commons. Pop. (1938) 729,400.

CHESHUNT, chës'ent, England, town in Hertfordshire, seven miles south of Hertford, and 14 miles north of London, on the Lea. From 1792 to 1905 it was the seat of Cheshunt Theological College. Pop. (1938) 16,940.

CHESNEY, chës'nî, Charles Cornwallis, English soldier and author: b. near Kilkeel, Down, Sept. 29, 1826; d. March 19, 1876. He was a well-known military engineer, but was still better known as a writer on military themes, publishing *Campaigns in Virginia and Maryland* (1863); *Waterloo Lectures* (1868); and *Essays in Military Biography*. (1874).

CHESNEY, Francis Rawdon, British soldier and explorer: b. Annalong, County Down, Ireland, March 16, 1789; d. Mourne, Jan. 30, 1872. Designated for a military career, he became a cadet, and in 1805 was gazetted to the royal artillery. On a tour of inspection in Egypt and Syria in 1829-1831 he proved the Suez Canal to be a feasible project, and on the strength of his report Ferdinand Marie de Lesseps undertook the great enterprise. At the same time he developed a plan for the opening of a route to India through Syria and the Persian Gulf, and headed two expeditions to the Euphrates River. The first, in 1835, proved that the Euphrates was navigable for steam vessels from a point about 120 miles from the Mediterranean to the Persian Gulf. The second expedition, in 1856, had the purpose of examining the possibilities of a railway through the Euphrates valley. The result was highly satisfactory, but the plans were never realized. He became a general in 1868.

Chesney published *Expedition for the Survey of the Rivers Euphrates and Tigris* (1850); *A History of the Past and Present State of Firearms* (1852); and *Narrative of the Euphrates Expedition* (1868).

CHESNEY, Sir George Tomkyns, British Indian Army officer and author: b. Tiverton, England, April 30, 1830; d. London, March 31, 1895. Wounded in the assault on Delhi (1857), he had a brilliant army career, attaining the rank of full general in 1892, when he was also elected to Parliament. He planned the Royal Indian Civil Engineering College at Cooper's Hill, Staines, and returned from India to serve as its first president in 1871. That year he contributed to *Blackwood's Magazine* his famous skit, "The Battle of Dorking, or Reminiscences of a Volunteer," republished in pamphlet form and translated into many languages. It described an imaginary German invasion and conquest of England, and was the prototype of the many warning novels issued in England on the eve of World Wars I and II. The keynote of his novel *The True Reformer* (1874) was army reform. Other novels include *The Dilemma* (1876) and *The Private Secretary* (1881).

CHESNUT, chēs'nūt, Victor King, American chemist and botanist: b. Nevada City, Calif., June 28, 1867; d. August 1938. Upon graduation from the University of California in 1890, he pursued postgraduate work at the University of Chicago and Columbia (now George Washington) University, Washington, D.C. In 1894-1904 he was assistant botanist in charge of the poisonous plant investigations carried out by the Bureau of Plant Industry, United States Department of Agriculture. From 1907 to 1916 he was assistant chemist of the division of drugs and from 1924 to 1933 associate chemist of the department's Bureau of Chemistry.

His works include *Principal Poisonous Plants of the United States* (1898); *The National Museum in Drug Research* (1908); and several monographs on the odorous constituent in different fruits and plants.

CHESNUTT, Charles Waddell, American Negro educator and lawyer: b. Cleveland, Ohio, June 20, 1858; d. there, Nov. 15, 1932. While still a child he was taken to North Carolina where he was educated at the State Normal

School at Fayetteville, of which school he became principal in 1881. Later he removed to New York City, where he practiced journalism while studying law. Returning to Cleveland, he was admitted to the Ohio bar in 1887.

He is best known as the author of *The Conjure Woman* (1899); *The Wife of His Youth and Other Stories* (1899); *Life of Frederick Douglass* (1899); and *The Colonel's Dream* (1905).

CHESS, chēs, a game for two contestants, played on a square board consisting of 64 squares of alternating colors, arranged in 8 rows of 8 squares apiece. Each contestant has 16 chessmen of 6 different designs, which he moves on the board in accordance with prescribed procedures. Since the board is the same as that for checkers (q.v.), the two games are often compared and contrasted; there are, however, fundamental differences.

The date of origin of chess is disputed by various researchers. Some consider that it was known as far back as Homer's time. More maintain that the game was not developed until some 600 years after the start of the Christian era. Other students hold that the time of its birth cannot be fixed, since it was evolved from much older games. Most authorities agree that its roots probably stem from remote antiquity in India, undergoing along the way many alterations. The last changes governing the moves and rights of the different chessmen were made in Europe in the 16th century. Since then the game has remained unchanged, except for tournament rules.

Chess is played in all civilized countries, and its great popularity has made it one of the most generally permitted recreational activities among prisoners of war.

Chessmen and Their Moves.—The chessboard and the location of the different kinds of chessmen at the beginning of a game are illustrated in the accompanying diagram.

The opponents in a chess game are customarily designated as "white" and "black." Each contestant has 8 "pieces," as they are called, on the row nearest him, consisting of 1 king, 1 queen, 2 bishops, 2 knights, and 2 rooks; and in front of the pieces a row of 8 "pawns." The board should always be set up in such a position that there is a single "white" square at the near right-hand corner of each player. The squares on many boards are of other colors than black and white, but technically the lighter ones are considered "white" and the others "black."

White always moves first, then the moves are taken alternately. The legal moves of the pieces and pawns are as follows:

KING—One square only, forward, backward, to either side, or diagonally.

QUEEN—Any number of squares, forward, backward, to either side, or diagonally.

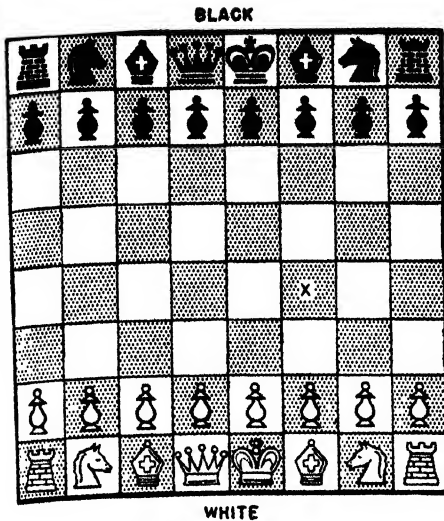
ROOK—Any number of squares, forward, backward, and to either side.

BISHOP—Any number of squares diagonally. Hence a bishop may never be on a square of different color from that on which he started.

KNIGHT—This is the only chessman which does not travel in a simple move, either forward, or backward, or to the side, or diagonally, but has a peculiar movement that combines 2 steps (squares) forward, backward, or to either side, and thence 1 step (square) to either side.

PAWN—Only straight forward, 1 square at a time, except for its first move which may be of 1 or 2 squares at the player's option.

In addition to the different movements, some chessmen have other powers and limitations:



Left: Chessboard, as it appears at the start of a game, with the 32 pieces in their original positions, illustrated by their conventional symbols. Right: Corresponding diagram showing the standard abbreviations for the names of the pieces, with the rows numbered for the purpose of designating the squares. Thus: the square marked X is White's K14, while it is also Black's KB5.

BLACK

8	QR	QK1	QB	Q	K	KB	KK1	KR	1
7	P	P	P	P	P	P	P	P	2
6									3
5									4
4						X			5
3									6
2	P	P	P	P	P	P	P	P	7
1	QR	QK1	QB	Q	K	KB	KK1	KR	8

WHITE

(1) Any of the pieces may capture an opposing piece or pawn located on any square to which it legally moves, thereby causing removal of the opponent's man from the board.

(2) A pawn captures only by moving 1 square diagonally forward to its right or left. The French term *en passant* is applied to the following capturing privilege of the pawns. When, for example, a black pawn has advanced to a position where a white pawn's first move of 2 squares brings the two pawns side by side on the same row, the black pawn may capture this white one by moving forward diagonally 1 square into position behind the white pawn.

(3) If a pawn reaches the last row nearest the opponent, the owner may exchange it for any piece.

(4) A knight's move is not impeded by the presence of other men on intervening squares; in effect, it leaps over them. No other piece (or pawn) may move over an occupied square, but may move onto it if that square is occupied by an opponent's chessman, thus capturing the latter.

(5) The king and either rook together have a special right, called "castling" because "castle" was an earlier name for the rook. Castling can be applied only once by each player during a game, and consists of the following movement: The king is moved 2 squares toward the rook, which then leaps over the king laterally to the adjoining square. This is the only time during a game of chess that a player may move 2 chessmen at the same time. Castling is possible only if neither king nor rook has been previously moved, if there is no other chessman between king and rook, and if the king is not in check and does not have to move over a square that is threatened by an opponent's man.

Check and Checkmate.—The king can never be captured. It can never move into a position where an opponent's man could capture it in one move, that is, move into "check." If the aggressor puts the opposing king in check, he must state so, saying "Check!" The endangered king must be brought "out of check" by moving the king, by capturing the attacking man, or (except in the case of check by a knight) by interposing one of its own men. If it is impossible to bring the king out of check, it is "checkmated," and the game is won by the opponent.

Capturing the opponent's men and outmaneuvering him in position are the two main devices available for winning the game. Besides games which result in a checkmate—hence victory for one or the other player—there are "drawn games," or ties. Very often games among the greatest players produce a surprising percentage of draws. (In a match between José Raoul Capa-

blanca and Alexander Alekhine in 1927, out of 34 games no less than 25 were draws.) A draw may result from several factors:

(1) Inadequate forces: This is the case when the men left on the board are insufficient to assure the power of one player to force a checkmate.

(2) Perpetual check: This applies if a position is attained where one player may repeatedly check the opponent's king as often as he wishes without being able to force a checkmate.

(3) Stalemate: This results from a situation where a king is not in check, but where its player cannot make a move without putting it in check.

A draw may also be claimed in no fixed time acceptance of the claim between the players.

Notation and Competitions.—In order to express the moves of chessmen on the board in writing, for example for textbooks, newspapers, magazines, and long-distance games, as well as to chronicle the games of a tournament, a special mode of notation has been adopted. The chessmen are indicated by abbreviations; in the case of two pieces with the same name, they are distinguished as king's or queen's pieces in conformity with their original positions on the king's or the queen's side.

King	.....	K	Queen	.....	Q
King's bishop	.....	KB	Queen's bishop	.....	QB
King's knight	.....	KKt	Queen's knight	.....	QKt
King's rook	.....	KR	Queen's rook	.....	QR

Each pawn is indicated by relation to the piece in front of which it stood at the beginning of the game. The pawn in front of the queen's bishop, for instance, is called the queen's bishop's pawn, though it is represented merely with the symbol P, since it is easy to keep track of the pawns.

Also clearly identified are the squares of the board: The rows extending horizontally from the left to the right, with the board in playing position, are called ranks. Those extending vertically between the two players are called files. Each file is designated according to the piece originally posted on its first rank (again distinguished by the prefix K or Q if necessary), and the ranks are numbered from 1 to 8, each player counting from his side.

If, therefore, "white's" first move advances the king's pawn 2 steps, it would be described

as follows: P—K4; and accordingly, KKt—B3 would indicate that the king's knight moved to the 3d square in the (king's) bishop's file (since it could not have moved to the queen's bishop's file, the prefix K can be left out).

A succession of moves is therefore chronicled in this fashion:

White	Black
1. P—K4	1. P—K4
2. KB—B4	2. KB—B4
3. Q—K5	3. KKt—B3
4. Q takes BP (checkmate).	

A capturing move may be indicated by the symbol X, while the following sign may be used for castling: O—O if the king's rook is involved, and O—O—O for castling with the queen's rook. To mark the best move, (!) is sometimes used; for a weak one, (?).

Many experts can keep in mind the exact situation in a number of games played simultaneously. The featured star usually goes from table to table, making his moves after having seen the opponent's move, while the latter has time to ponder his move until the star returns. In other cases a great player may even play blindfolded, being told which moves the opponents have made, and indicating his moves in code. Up to 45 games have been played blindfold and simultaneously by great masters of the game. Almost invariably in such a contest, the featured star wins appreciably more games than he loses, and to score a draw against him is usually considered a moral victory by his little-known opponents.

We know the names of many brilliant chess-players, especially in Italy, France, and Spain, as far back as 1500 A.D., but with the first international chess tournament in London in 1851, the era of the "world champions" began. The winner of that tournament, Professor Adolf Anderssen of Germany, was recognized as the world's greatest player, and when he was defeated in 1866 by the Austrian player, William Steinitz, the latter claimed the title of world champion. Subsequently other stars of various nations rose to fame. Such masters of chess as Paul Charles Morphy, Harry Nelson Pillsbury, Emanuel Lasker, Alexander Alekhine, Siegbert Tarrasch, and José Raoul Capablanca, to name some of the outstanding ones, have competed in international tournaments.

Highest ranking among American players were doubtlessly P. C. Morphy (1837–1884), the first United States champion, and Frank James Marshall (1877–1944), who is said to have been unable to make an ordinary move if he could see an unusual one that bore the slightest promise of success.

Hints on Play.—Throughout the literature on chess, strategy and tactics are treated under three broad divisions: openings, mid-game tactics, and end-game play; but since the variety of possible moves is immense, the multitude of theories on chess is equally great. However, some of the fundamental principles, helpful to every beginner, may be briefly summarized:

(1) At all stages the player should plan ahead, giving heed to both his attack on the opponent and the defense against the opponent's campaign as it develops.

(2) A player should not stress the mobilizing of his "big" pieces (the rooks and the queen, as distinguished from the "small" bishops and knights) too early.

(3) Pawns should be moved so as to protect one another and their pieces. It is most important that the player should keep two or three in position to protect the king.

(4) As a rule, one should castle early. It serves two

purposes: to guard the king, and to bring the rook into a useful position.

(5) In order to improve his "chess thinking," a player should study the different openings, mid-game tactics, and end-game plays given in all sound books on chess.

(6) Solving chess problems and reconstructing famous games, trying to analyze every movement, is indispensable for a player who wants to succeed.

Chess has always attracted the interest of various people with different talents, and some curious products resulted:

A sensation was created when the Austrian mechanic Wolfgang von Kempelen (1734–1804) introduced his "Automaton," a picturesque figure of a Turk seated at a chessboard. This figure could play as any human being, and was thought to be entirely mechanical. Later exposed, it was shown that a very skillful player was concealed inside the base upon which the ensemble was erected; this player, by a very ingenious device, could operate the figure on top.

Another remarkable feature of chess consists of mammoth games with costumed human beings as chessmen. The largest-scale game of this kind is said to have been played in Stockholm, Sweden, in the late 1890's on a board of 4,305 square feet.

At all times master craftsmen have devoted their work to the creation of elaborate sets—precious pieces of art—using such materials as bone, ivory, rare woods, mother of pearl, gold, and jewels.

SHEPARD BARCLAY.

Bibliography.—The earliest book on chess was *Liber de Moribus Hominum et Officiis Nobilium Super Ludo Scacorum*, written before 1300 by the Italian Dominican friar Jacobus de Cesolis. The book was later translated into several European languages, and in 1474 William Caxton translated it from a French version and printed it in 1479 under the title *The Game and Playe of Chess*, one of the earliest incunabula in English. Other works include: Capablanca, J. R., *Chess Fundamentals* (London 1942); Fine, Reuben, *Chess the Easy Way* (New York 1942); Lasker, Emanuel, *Manual of Chess* (New York 1947); Reinfeld, Fred, *The Treasury of Chess Lore* (New York 1951); and Hollings, F., *The Beginner's Book of Chess* (New York 1953).

CHEST, in man and the higher vertebrates the cavity formed by the breast bone or sternum anteriorly, the ribs and spine laterally and posteriorly. The diaphragm separates it from the abdominal cavity below. It contains such vital organs as the heart (within the mediastinal cavity), the great vessels of the heart, the lungs, the trachea or windpipe and its branches the bronchi, many important nerves and ducts, and the esophagus or gullet. Diseases affecting the organs of the chest are many, while chest deformities are encountered often, as a result of pulmonary and pleural infections, infantile paralysis (poliomyelitis), postural scoliosis, and congenital malformations. See also **ANATOMY**, **COMPARATIVE**; **DISEASE**; **HEART**; **LUNGS**; **THORAX**.

HAROLD WELLINGTON JONES, M.D.,
Editor, "Blakiston's New Gould Medical Dictionary."

CHEST, a large box of wood or metal with a hinged top. Chests have always been widely used and were part of the earliest furniture almost everywhere. Mainly used as a receptacle for clothes and valuables, the chest in former days served sometimes as seat, table, or even bed. Used by the rich of the Middle Ages as a portmanteau, it was sometimes covered with leather. Like other furniture, chest designs changed with the architecture; craftsmen of all epochs have decorated them with paint or wood-carving, chisel-

ing or inlay, according to the current style and the material used.

CHESTER, Colby Mitchell, American naval officer: b. New London, Conn., Feb. 29, 1844; d. Rye, N. Y., May 4, 1932. He graduated at the United States Naval Academy in 1863, and in the American Civil War served at the Battle of Mobile Bay and in the capture of Fort Morgan (1864) and Mobile (1865). Subsequently he was engaged on naval coast survey work (1877-1885) and became commandant of the Naval Academy (1891-1894), commander in chief of the South Atlantic Squadron (1897-1898), and superintendent of the Naval Observatory (1902-1906). He reached the rank of rear admiral in 1903, and three years later he was retired. After retirement he headed the Ottoman Development Company, which secured from the government of the Ottoman Empire the "Chester concession" to construct a railroad through Anatolia and the Mosul oil region. The successor government of the Republic of Turkey raised objections to the concession, and at the Lausanne Conference in 1923 it caused complications because of its conflict with other concessions and with British interests in Mesopotamia and French interests in Syria. Soon after the Lausanne Conference Turkey annulled the concession on the ground that certain preliminary conditions had not been complied with.

CHESTER, George Randolph, American novelist and short-story writer: b. Ohio, 1869; d. New York City, Feb. 26, 1924. After engaging in various occupations he turned to journalism, first working as a reporter on the *Detroit News*; subsequently he transferred to the *Cincinnati Inquirer*, eventually becoming Sunday editor. He gave up journalism to write magazine stories; and with Lillian de Rimo, his second wife, he collaborated in writing several novels, among them *Cordelia Blossom* (1914; play, 1914), *Runaway June* (1915), *The Enemy* (1915), and *On the Dot and Off* (1924). It was, however, his invention of the fictional character Get-Rich-Quick Wallingford, a shady company-promoter, that brought him great fame and financial success. His numerous books included *Get-Rich-Quick Wallingford* (1908); *Cash Intrigue* (1909); *The Making of Bobby Burnit* (1909); *The Art of Short Story Writing* (1910); *Young Wallingford* (1910); *The Early Bird* (1910); *Wallingford and Blackie Daw* (1913); and *Wallingford in His Prime* (1913). After World War I he entered the motion picture industry as writer and director, and continued to contribute stories to the *Saturday Evening Post* and other periodicals.

CHESTER, Joseph Lemuel, American genealogist: b. Norwich, Conn., April 30, 1821; d. London, England, May 26, 1882. He was musical editor of *Godey's Lady's Book* from 1845 to 1850, and in 1852 he became one of the editors of the *Philadelphia Inquirer*. From 1858 he made his home in London, where he made special researches into the ancestry of American families and investigated the English descent of noted Americans, especially that of George Washington. He was a founder in 1869 of the Harleian Society, which published his greatest work, *The Marriage, Baptismal, and Burial Registers of the Collegiate Church or Abbey of Saint Peter, Westminster* (1876). Other writings included *Edu-*

cational Laws of Virginia: the Personal Narrative of Mrs. Margaret Douglas (1854); *John Rogers, the Compiler of the First Authorised English Bible* (1861).

CHESTER, city, England, county seat of Cheshire, 15 miles south of Liverpool. The two main streets cross each other at right angles and were cut out of the rock by the Romans, 4 to 10 feet below the level of the houses. The houses in these streets were curiously arranged; the front parts of their second stories, as far back as 16 feet, form a continuous paved promenade or covered gallery, open in front, where there are pillars and steps up from the street below, with private houses above, inferior shops and warehouses below, and the chief shops of the town within. These arcades, called the "Rows," together with the walls and the half-timbered construction of many of the houses, with ornamental gables of the 16th century, render Chester perhaps the most picturesque city in England. St. John's Church (later [1075] St. John's Cathedral), now partially in ruins, is supposed to have been founded in 698. The cathedral church of Christ and the Virgin Mary, formerly the church of the abbey of St. Werburgh, embraces Norman to Late Perpendicular styles of architecture; it is surmounted by a central tower 127 feet high, and has a splendid Perpendicular west window. Henry VIII founded the King's School in 1541. Chester still preserves its old walls, two miles in circuit in their entirety. They date from the 14th century, replacing Norman and Roman ones, but the gates are of the 18th century. Many modern improvements have been made in the city, but with due regard to the quaint architectural features. Leather goods and paint are manufactured, as well as chemicals and boots and shoes.

Chester, which is situated on a rocky eminence on the river Dee, was known to the Romans as *DEVA*, or *DEVANA CASTRA*. The military station was founded there about 48 A.D., and subsequently it became the station of the famous 20th Legion. It was destroyed by Ethelfrith during the first decade of the 7th century, and lay in ruins until Ethelfreda rebuilt it about 907. Chester was, in 1070, the last place in England to succumb to William the Conqueror. In 1255 it suffered devastation by Llewellyn. It espoused the cause of the royalists in the English Civil War, and after a two-year stubborn siege (1644-1646) it was starved into capitulation. Pop. (1949 est.) 47,850.

CHESTER, city, Illinois, seat of Randolph County, on the Mississippi River 58 miles south-southeast of East Saint Louis; it is served by the Missouri Pacific and the Saint Louis and Southwestern railroads. It is a shipping center for iron, lead, sand, and coal; and there are manufactures of shoes, hosiery, and flour. It is the seat of the Southern Illinois Penitentiary. Fort Kaskaskia State Park is on the site of an early trading post and the first capital of Illinois. Government is by mayor and council. Pop. (1940) 5,110; (1950) 5,388.

CHESTER, city, Pennsylvania, a port of entry on the Delaware River, in Delaware County 14 miles west-southwest of Philadelphia. It is served by the Pennsylvania, the Baltimore and Ohio, and the Reading railroads and by

steamship lines. The city is the trade and shipping center of a highly developed industrial district, and has one of the largest shipyards and drydocks in the country. Chester's huge industrial interests comprise great steel mills, munitions and locomotive works, oil refineries, automobile assembly plants; manufactures of textiles, chemicals, paper products and floor coverings; and many smaller enterprises. Chester's retail trade area covers more than half of Delaware County, with a population tripling that within the city limits, and there are suburban industrial activities of major importance, greatly extending the metropolitan area. The city has excellent public parks; the Deshong Memorial Art Gallery; the J. Lewis Crozer Library; Pennsylvania Military College; and Crozer Theological Seminary (Baptist). Near by are Haverford, Swarthmore, and Villanova colleges. Of especial interest are the Caleb Pusey House (1683), the oldest building standing intact in Pennsylvania; Old Court House (1724); and Washington House (1747), where Washington wrote his report of the Battle of Brandywine, Sept. 11, 1777. Settled by the Swedes in 1644, and called Upland, Chester is the oldest town and second settlement in the state, the first settlement at Tinicum Island having disappeared. It came under Dutch control in 1655, and English in 1664, and its name was changed to Chester by William Penn when he landed here Oct. 28, 1682 on his way to Philadelphia. Chester became a borough in 1701 and was Delaware County seat from 1789 to 1851; it received a city charter in 1866. It has a mayor and council. Pop. (1940) 59,285; (1950) 65,824.

CHESTER, city, South Carolina, seat of Chester County, 18 miles south-southwest of Rock Hill; it is served by the Southern, the Carolina and Northwestern, the Lancaster and Chester, and the Seaboard Air Line railroads. There are granite works and manufactures of cotton textiles, yarn, flour, pulp wood, fertilizer, and novelty furniture. It lies in a cotton, farming, and livestock region, and also manufactures dairy products. The city was settled and named by Pennsylvanians about 1756. Pop. (1940) 6,392; (1950) 6,891.

CHESTER, city, West Virginia, in Hancock County at the northern tip of the West Virginia panhandle. Largely a residential city, there are manufactures of pottery, china, and roofing materials. The water works are owned and operated by the city government. Pop. (1940) 3,805; (1950) 3,767.

CHESTER STAGE, the youngest of the limestones laid down in the interior sea that covered in Lower Carboniferous or Mississippian time, much of what is now the Mississippi Valley. Limestones of this stage are found in Texas, Arkansas, Kentucky, Tennessee, and Alabama, and in places reach a thickness of 1,500 feet. Some of the Lower Carboniferous limestones of West Virginia correspond in age to the Chester. The characteristic fossils include several genera of crinoids and brachiopods. See also CARBONIFEROUS.

CHESTERFIELD, 4TH EARL OF (PHILIP DORMER STANHOPE), English statesman and man of letters: b. London, Sept. 22, 1694; d. there,

March 24, 1773. He was educated at Trinity Hall, Cambridge, and in 1715, after a tour in Europe, he was appointed a gentleman of the bed-chamber to the Prince of Wales. From 1716 to 1726 he sat in the House of Commons as a Whig, representing Saint Germans, Cornwall, and there displayed his considerable talents as an orator. In 1726 he succeeded his father as earl, and in the House of Lords soon exerted considerable influence. From 1728 to 1732 he was ambassador to The Hague, a post which he filled with great dexterity. His natural son, Philip (1732-1768), was born to him by a Mlle. Elizabeth du Bouchet. In 1730 he had been appointed lord high steward, but he was dismissed from this post in 1733 by Sir Robert Walpole because of his opposition to the prime minister's excise bill. Thereafter he led the opposition in the House of Lords, and in 1733 he caused deep offense to George II by his marriage to the countess of Walsingham (Melusina von der Schulenburg), illegitimate daughter of George I; he adopted his godson, a distant cousin named Philip Stanhope (1755-1815), as heir to his title and estates. He waged a bitter campaign against George II and his government, writing satirical letters under the name of Geoffrey Broadbottom. In 1744 he joined the ministry of Henry Pelham and shortly was sent as ambassador to The Hague; there he succeeded in persuading the Dutch to join in the War of the Austrian Succession. He went to Ireland in 1745 as lord lieutenant, a post which he filled with notable success, and from 1746 to 1748 he served as one of the principal secretaries of state. Retiring from public affairs in 1748, he devoted the remainder of his life almost entirely to study and the society of his friends. Because of his belated eulogy of Samuel Johnson's *English Dictionary*, in 1755 the great lexicographer rebuked him in a famous reply: "... had it been early, had been kind; but it has been delayed till I am indifferent, and cannot enjoy it; till I am solitary and cannot impart it; till I am known, and do not want it." His talents as an author were displayed in several moral, critical, and human essays, in his parliamentary speeches, and particularly in a collection of letters to his son (see CHESTERFIELD'S LETTERS TO HIS SON) which recommended grace of manners as the most essential quality for a man of the world. Another series of letters addressed to his godson showed Chesterfield in a more favorable light. To the charms of wit and grace he united good sense, a thorough knowledge of the manners, customs, and political condition of Europe, and a polished style.

CHESTERFIELD, municipal borough, England, in Derbyshire 11 miles south of Sheffield. It is situated within rich coal and iron fields, and has manufactures of steel, textiles, and pottery. The beautiful 14th century Gothic church is remarkable for its crooked wooden spire, 228 feet high and six feet out of the perpendicular. There is a grammar school founded in 1538; and Stephenson Memorial Hall was built in 1879 in memory of the English inventor, George Stephenson, whose last years were spent in the vicinity. An ancient and historic place, Chesterfield figured in several important battles of the feudal and civil wars. Pop. (1949 est.) 67,960.

CHESTERFIELD INLET, Canada, an inlet of Hudson Bay in the eastern part of the

Keewatin District, Northwest Territories. It is 250 miles long and 25 miles wide, and inland it expands into Baker Lake.

CHESTERFIELD ISLANDS, a group of 11 coral islets in the central Coral Sea, northwest of New Caledonia and 285 miles west of the Huon Islands, politically within the French overseas territory of New Caledonia. The aggregate area is about 4 square miles. There are no indigenous inhabitants. Rich guano deposits are leased to the Austral Guano Company, Limited, of Melbourne, Australia.

CHESTERFIELD'S LETTERS TO HIS SON. The letters of Philip, 4th earl of Chesterfield (q.v.) to his illegitimate son, Philip Stanhope, are to be distinguished from the letters to his godson and successor of the same name. Neither set was meant for publication. The *Letters to His Son* were written between July 1737, when the boy was five and one half years old, and 1768, when Philip Stanhope died. Composed in English, French, and Latin, they were designed to convey instruction—both by repeated precept and varied example—in language, history, literature, good manners, morality, and a general knowledge of mankind. At the age of six the boy receives Dryden's fine lines:

When I consider life, 'tis all a cheat;
Yet, fooled with hope, men favour the deceit.

For a knowledge of men, advises Chesterfield, read La Rochefoucauld and La Bruyère. Study the French character sketches, comparing them with persons you know. Better read one man than 10 books. Human nature, ever the same in essence, is varied in its operations. Discover the ruling passion deep in the heart of the individual; do not trust him where that is concerned. Avoid vulgar liaisons—cultivate polite arrangements. Choose and cultivate the best in all domains of life, but do not necessarily enter the lists as champion of anything. Let people enjoy quietly their errors both in taste and religion. Do not tell everything; acquire the art of dissimulation, and distinguish between this and simulation—never lie. The greatest fools are the greatest liars. But the father loved his son, and knew how to be a friend. His letters are full of real, not feigned, interest, and have something for every reader. Neither the son nor the godson became a pattern of wit and good breeding; but it is unfair to say that the solicitude of their mentor was lavished on them in vain. A complete edition of Chesterfield's *Letters to His Son* did not appear until 1890 (Lord Carnarvon's).

CHESTERTON, chës'tër-t'n; -tün, Gilbert Keith, English journalist and author: b. London, May 29, 1874; d. Beaconsfield, England, June 14, 1936. He attended St. Paul's School, London, where he won the Milton prize for English verse, but left in 1891 to study art at the Slade school. He began his literary career by reviewing art books for *The Bookman*. His first book, *The Wild Knight*, was published at his father's expense in 1900. While turning out volume after volume, he edited *G.K.'s Weekly*, contributed a page of causerie to the *Illustrated London News* each week, and wrote special articles for many other periodicals. Turning from verse to prose, in 1901 appeared *The Defendant*, first a series of books attacking the *fin-de-siècle*

Victorian pessimists, wherein he defended conventionality in such an unconventional manner that he soon came to be known as "the master of paradox." This was followed by *Twelve Types* (1902), and *Heretics* (1905). He was at his best in literary criticism, and his studies of Robert Browning (1903), Charles Dickens (1906), George Bernard Shaw (1909), and R. L. Stevenson (1927) were not only brilliant but of lasting value. As a poet he could be either rhetorical or humorous. His best verse is included in *Collected and New Poems* (1927). In fiction his fancy found free play and he used this medium for the expression of his pet ideas. *The Napoleon of Notting Hill* (1904) was a fantastic dream-history of civil war between London suburbs. *The Club of Queer Trades* followed in 1905; *The Man Who Was Thursday*, in 1908; *The Ball and the Cross*, and an autobiography, *Orthodoxy*, in 1909. Then he turned to detective fiction and his series of "Father Brown" stories (1911, 1914, 1926, 1927, 1935) and *The Man Who Knew too Much* (1922) won great popularity.

In 1922 Chesterton entered the Roman Catholic Church and thereafter he championed Catholicism in many of his most ambitious works. His later books included *St. Francis of Assisi* (1923); *The Everlasting Man* (1925); *The Judgment of Dr. Johnson* (play, 1927); *Generally Speaking* (1929); *The Poet and the Lunatics* (1929); *Catholic Essays* (1929); *St. Thomas Aquinas* (1933).

CHESTERTOWN, town, Maryland, seat of Kent County, on the Chester River 32 miles east-southeast of Baltimore, it is served by the Pennsylvania Railroad. It lies in a fruit-growing region, and manufactures include hosiery, lumber products, and fertilizer. Washington College is here. Pop. (1940) 2,760; (1950) 3,135.

CHESTNUT, chës'nüt, genus *Castanea*, of trees and shrubs of the beech family Fagaceae. The species are usually self sterile, requiring more than one tree for the production of nuts. The flowers consist of long catkins, which may contain the female or fruit-bearing organs at their base, or may be purely male or staminate. If the female flowers are fertilized they develop spiny burs, containing one to five nuts. There are two groups of species, the chestnuts proper and the chinquapins (chinkapins). Of the chestnuts, the American species, *C. dentata*, was formerly of great economic importance throughout its range in the eastern United States, being a tall timber tree. Its wood, which was very durable in the soil, was of particular value for telegraph and telephone poles, for construction timbers and railroad ties. But a fungus, *Endothia parasitica*, imported on Oriental chestnuts, probably in the 1890's, and causing the disease known as "chestnut blight," has now destroyed virtually all trees throughout their native range, so that now only basal shoots from the stumps of these trees remain. The nuts of the American chestnut were sweet and edible, though comparatively small. The principal Oriental chestnuts, *C. mollissima*, the Chinese, and *C. crenata*, the Japanese, are more or less resistant to the blight the former very much so, but these species cannot replace the American chestnut for timber, because of their smaller size. Hence the United States Department of Agriculture, the Brooklyn Botanic Garden, and the Connecticut Agricultural Experi-

ment Station have been interbreeding the Oriental species with the American in order to obtain a blight-resistant hybrid of timber type. Chinese-American and Japanese-American crossed with Chinese chestnut hybrids give promise of fulfilling this aim. The European chestnut, *C. sativa*, a native of southern Europe, was attacked by the blight fungus in 1938, and the disease is spreading throughout Italy, Spain, Portugal, Switzerland, and Yugoslavia. So far it has not been found in France. Since the nuts, because of their large content of starch, and also the timber, are of great value to the southern Europeans, the situation is serious. The chinquapins are usually smaller, bushlike species, with only one nut in the bur. The commonest in the United States is the Alleghany chinquapin, *C. pumila*, a native of the southeastern United States. Its nuts are small, but suitable for wild life. Because of the shrubby nature of this species, the blight is not usually fatal. Several other small chinquapins occur in the southeastern United States and also in China. The Ozark chinquapin, *C. ozarkensis*, native from southwestern Missouri to Arkansas, is a small tree but susceptible to the blight. The Henry chinquapin, *C. henryi*, a native of central and western China, is a large tree, attaining 90 feet, but also susceptible to the blight.

ARTHUR H. GRAVES.

CHETTLÉ, Henry, English dramatist: b. 1560?; d. ?1607. First heard of as editing Robert Greene's *Groatsworth of Wit* (1592), which refers to a dramatist, probably Shakespeare, as an "upstart crow," he apologized in a preface to *Kind Harts' Dreame* (?1593), an exposure of some of the abuses of his time. That he wrote for the stage we learn from Francis Mere's *Palladis Tamia* (1598), in which he calls Chettle the "best for comedy amongst us." *Englands Mourning Garment* (1603), an elegy on Queen Elizabeth, was well received. It refers to the poets under fictitious names, one verse supposed to be to Shakespeare as "silver-tongued Melicert."

CHETUMAL, chā-tōō-māl', town, Mexico, capital of the territory of Quintana Roo. It is a small town situated on the western side of Chetumal Bay near the mouth of the Rio Hondo. It is primarily a port and trading center for chicle contractors and for the wood trade, particularly that in mahogany. Pop. (1940) 4,672.

CHETWODE, chēt'wōd, Lord Philip Walhouse, 1st Baron Chetwode, English soldier: b. Rangemore, Staffordshire, England, Sept. 21, 1869; d. London, July 6, 1950. Educated at Eton College, he entered the army in 1889 and achieved regular promotion, serving in Burma, South Africa, and in World War I. After his cavalry brigade had covered the retreat from Mons, he went to Egypt in command of the Desert Corps, and later played a prominent part in the capture of Jerusalem as commander of the 20th Army Corps. He received many decorations for his gallantry.

In 1919 he was military secretary in the War Office; from 1930-1935 commander in chief of the army in India. During World War II he served as chairman of the executive committee in the British Red Cross and St. John joint war organization, and until 1948 was constable of the royal palace and the Tower of London. He was

gazetted field marshal in 1933 and created a baron in 1945.

CHEVAL, shē-vāl', A (Fr. *cheval*, horse); on horseback, astride any object. In a military sense, a body of troops is said to be à *cheval* of a river, if one wing is stationed on the right and the other on the left bank.

CHEVALIER, shēv-à-lēr', Albert, English comedian: b. London, England, March 21, 1861; d. there, July 10, 1923. Of Italian, French, and Welsh blood, he early showed a natural talent for the stage, and when 16 made his first professional appearance in London. For many years he toured with the Kendals, John Hare and George Alexander, but began his music hall career at the London Pavilion in 1891, singing the coster songs that brought him instant success. Many of these songs were still sung in World War II by the troops, such as *Knocked 'em in the Old Kent Road*, *The Future Mrs. 'Awkins*, and *My Old Dutch*. He toured the United States and Canada under the management of Charles Frohman and was a great success. His last London appearance was in a play *My Old Dutch*, founded on his popular song. Besides over 100 sketches, monologues, and plays he wrote a volume of reminiscences, *Before I Forget* (1901).

CHEVALIER, shē-vā-lyā', Maurice, French actor: b. Ménilmontant, near Paris, France, Sept. 12, 1888. His music hall career began in 1904, interrupted by service in the army in World War I, after which he became very popular singing a type of light French song and wearing a straw hat that became his trademark. He appeared in other countries, made films, chiefly *The Love Parade* (1929); *The Big Pond* (1930); *The Merry Widow*, and *Folies-Bergère* (1935). In World War II he remained in occupied France, entertaining the troops and prisoners. In 1947-1948 he again toured the United States and Canada, besides starring in the René Clair (René Chomette) film *Le Silence est d'or*. He published *Man in the Straw Hat* in 1949.

CHEVALIER, Michel, French economist: b. Limoges, France, Jan. 13, 1806; d. Montplaisir, near Lodève, France, Nov. 28, 1879. Trained as an engineer, he became a fervent follower of the radical doctrines of Claude Henri Saint-Simon, which he advocated in the Saint-Simonist journal, *Le Globe*, until sentenced in 1832 to a year in prison. Upon the intervention of Louis Adolphe Thiers, the penalty was reduced and Chevalier soon after was entrusted with several government missions. Sent to the United States to study communications, he reported on his observations in a series of brilliant letters to the *Journal des Débats*. These letters were collected under the title, *Lettres sur l'Amérique du Nord* 2 vols. (1836). In 1840 he was appointed to the Collège de France as professor of political economy. Espousing in his lectures, publications, and political activities the cause of free trade, his efforts found an echo in England and were encouraged by Richard Cobden, with whom he negotiated in 1860 a trade agreement between France and England. In the same year he was named senator by Napoleon III. Chevalier defended the latter's intervention in Mexico, a country of which he wrote *L'expédition du Mexique* (1862) and *Le Mexique ancien et moderne* (1863).

among his other writings are *Essais de politique industrielle* (1843); *Cours d'économie politique* (1842-1850); and *Comment une nation rétablit sa prospérité* (1871).

CHEVALIER, Sulpice Guillaume. See **AVARNI**.

CHEVALIER, shěv-à-lěr', an honorary title given especially in the 18th century to younger sons of the French nobility. The chevalier was originally so called because he rode a horse; but only the nobles and others connected with the upper classes could afford horses, the term chevalier came to have the sense of a chivalrous man or gallant. James Francis Edward Stuart, the Old Pretender, was called the Chevalier or Chevalier de St. George, while his son Charles Edward Stuart, the Young Pretender, was called the Young Chevalier. A Chevalier is the lowest grade in the French Legion of Honor.

CHEVAUX DE FRISE, shě-vô' dē-frěz' horses of Friesland, so called because first used at the siege of Groningen, in that province in the Netherlands, in 1658), armed beams of square timber or iron used to defend the fronts of camps, breaches, or shores by closing them up. They are usually from 15 to 18 feet long, and connected by chains, each being perforated with small holes to receive rods of wood or iron, pointed at their extremities, and when moved in any direction making a hedge of spears. In their original form they were made of spears, sword blades and other steel instruments such as were readily found at hand in the army equipment.

CHEVERUS, shě-vrūs', Jean Louis Lefebvre de, French Roman Catholic prelate: b. Mayenne, France, Jan. 28, 1768; d. Bordeaux, July 19, 1836. During the French Revolution, as a priest he refused to take the constitutional oath required of the clergy, and fled to England, later to the United States, where in 1810 he became the first Roman Catholic bishop of Boston, Mass. He ministered to the Abenaki Indians in Maine and studied their language; was honored by President John Adams; returned to France in 1823, where he was made bishop of Bordeaux, and a peer of France by King Charles X in 1826. Pope Pius VII created him a cardinal in 1836.

CHEVES, chīv'is, Langdon, American banker: b. in Abbeville district, S. C., Sept. 17, 1776; d. Columbia, S. C., June 26, 1857. He began to study law at the age of 18, and rapidly attained eminence and wealth in its practice. As a representative in the national Congress before and after the War of 1812, he zealously supported the party which carried the declaration of war. In 1812 he was chairman of the Naval Committee and in 1813 of the Ways and Means Committee; he became speaker of the House in the Thirteenth Congress when Henry Clay was sent as commissioner to Ghent. In 1815 he returned to his law practice, but in 1819 accepted the position of president of the United States Bank. The bank had become hard pressed and was on the verge of closing, but Cheves, by rigorous retrenchment, and by making credits only upon sufficient securities, saved it, and specie payments were maintained at the principal centers of commerce. He withdrew from public life because of his convictions on the dangers of separate state action.

CHEVET, shě-vě', an architectural term, meaning a variety of apse, usually confined to French Gothic churches. The extreme end of the chancel or choir is called the *chevet*. The apses of chapels are made to radiate around the choir aisle. There are generally five apses, but, especially in early architecture from the 11th century, constructions with four apses are seen. Henry III introduced the *chevet* into England, in a part of Westminster Abbey. In some French churches there are only three; but there may be seven and in still others, nine, the second one of which was generally dedicated to the Virgin Mary.

CHEVILLARD, shě-vě-yàr', Pierre Alexandre Camille, French composer: b. Paris, France, Oct. 14, 1859; d. there, May 30, 1923. Son of the famous cellist Pierre Chevillard, he studied piano under Georges Mathias, but was mainly self-taught in composition. From 1886-1897 he was assistant conductor to his father-in-law, Charles Lamoureux, whom he succeeded. He continued the *Concerts Lamoureux* and maintained the high standard established by his predecessor. In 1903 he received the Prix Chartier for chamber music, and in 1913 became president of the French Chamber Music Society. In that year he became concertmaster at the Opéra. His compositions include a symphonic ballad, a symphonic fantasy, and many piano and cello works.

CHEVIOT, shiv'ī-ūt, city, Ohio, in Hamilton County, in the extreme southwest of the state, on the western outskirts of Cincinnati. On the Chesapeake and Ohio Railroad, it is mainly a residential city, but manufactures packing boxes, clothes, and rubber goods and has a meat packing plant. Settled in 1818, it is now incorporated and has a mayor and council. Pop. (1950) 9,944.

CHEVIOT HILLS, chěv'ī-ūt, a range on the borders of England and Scotland, stretching southwest to northeast for above 35 miles, the larger part of the range being in Northumberland, England, and the lesser part in Roxburghshire, Scotland. Their culminating point, known especially as the Cheviot, has a height of 2,676 feet; Carter Fell, the next in height, is a little more than 2,000 feet high. The hills are clothed for the most part with a close green sward, and are pastured by a celebrated breed of sheep admirably adapted for hilly districts. In these hills are formed the head waters of the Tyne, the Tweed, and other rivers of the border country.

CHEVIOT SHEEP, a breed of sheep of large size and valuable fleece, which has been pastured for centuries in the Cheviot Hills, on the border of England and Scotland, and which from its powers of endurance is justly regarded as one of the most valuable mountain sheep of Great Britain. The peculiar features of the Cheviots are the usual absence of horns in both sexes; white or grayish face and legs; a long head, destitute of wool, while both throat and neck are well covered; long open ears well covered with hair, and every indication of hardness. Well-fed ewes weigh approximately 125 pounds and wethers (castrated rams) may reach 200 pounds. The fleece weighs from three to four pounds in ewes and up to 12 pounds in rams. The Cheviots, though originally confined to a small area, are now widespread in all parts of the British Isles. Most sheep raised in northern

Scotland are of this variety. Cheviot wool is widely used for wearing apparel.

CHEVREUL, shě-vrûl', **Michel Eugène**, French chemist: b. Angers, France, Aug. 31, 1786; d. Paris, April 9, 1889. Educated in his native town, when still a youth he went to Paris, and was employed in the chemical factory of Louis Vauquelin. In 1813 he became chemistry professor in the Lycée Charlemagne, and in 1824 was made director of dyeing in the Gobelins tapestry works, and in 1830 took the chair of chemistry in the Museum of Natural History. He wrote *Leçons de chimie appliqué à la teinture* (1828-1831) and *De la loi du contraste simultané des couleurs*, translated into English as *Principles of Harmony and Contrast of Colors* (1839). His real fame, however, rests on his *Recherches chimiques sur les corps gras d'origine animale*, for his researches on animal fats led to improvements in soap and candle making; and to his discovery of oleine and stearine, which he named.

CHEVREUSE, shě-vrûz' **DUCHESSÉ DE (MARIE DE ROHAN-MONTBAZON)**, French political intriguer: b. Dec., 1600; d. Gagny, near Paris, Aug. 12, 1679. She intrigued all her life in love and politics. Twice married, first at 17 to the duc de Luynes, who died soon after, and then to Claude de Lorraine, duc de Chevreuse, she made many other conquests. As a friend of the queen, Anne of Austria, she was an inmate of the royal household, and had opportunities for opposing the duc de Richelieu and later Jules Cardinal Mazarin. Some of her exploits have been celebrated as fiction by Alexandre Dumas. Escaping from Richelieu, she swam the Somme in man's attire and fled to England. Finally Anne allowed her to return, in spite of Louis XIII's objections, and gave her a pension, but did not allow her as much confidence. After plotting against Mazarin, she became one of his spies.

CHEVROLET, shěv-rô-lâ', **Louis**, American automobile racer, designer, and manufacturer: b. La Chaux-de-Fonds, Switzerland, 1879; d. Detroit, Mich., June 6, 1941. Educated in France, where his family moved when he was a boy, he went to the United States in 1900 to represent a French concern in Brooklyn, N. Y. He became the world's leading automobile racing driver, defeating Barney Oldfield in 1905 for the first time at Sheepshead Bay, N. Y.

In 1911 he designed and built, with William C. Durant, the first Chevrolet automobile, but in 1914 sold out to Durant, who incorporated the firm in General Motors in 1915. Continuing as a racing driver, Chevrolet won the Indianapolis Speedway races in 1920 and 1921 with cars built to his own design. In 1925 he took up speedboat racing, adding to his triumphs, and later organized the Chevrolet Aircraft Company in Indianapolis. From 1936-1938 he returned to the Chevrolet company in a minor office.

CHEVRON, chěv'rûn (Fr. *chèvre*, a goat), in heraldry, a bent bar or shield, rafter shaped. A chevron is, according to some authorities, a third, and according to others, a fifth of the field. A chevronel is half a chevron, and the couple close the fourth of the shield. A chevron couped is that which does not reach the sides of the escutcheon. A chevron in chief is one which rises to the top of the shield.

In architecture a chevron is a zigzag molding, characteristic of Romanesque architecture in France, England, and Sicily. It is a common decoration of the Norman arch.

Its most familiar use is as a badge of rank by officers of armies, navies, police, and other uniformed bodies. See **INSIGNIA OF RANK, MILITARY AND NAVAL**.

CHEVROTAIN, shěv'rô-tân (Fr. *chevrot*), a family, Tragulidae, of ruminant ungulates, resembling true deer, particularly the musk deer in some respects, but considerably more primitive and sometimes called mouse deer. Besides the presence of canine tusks, the complete absence of antlers, face and foot glands, the stomach has only three chambers instead of four, the lateral metacarpals or hand bones are complete, as in the fibula or calf bone. Chevrotains are small animals, about a foot in height, and occur almost entirely in thickets and dense forests. Two genera are recognized, *Tragulus* of southeastern Asia, and *Hyemoschus* of West Africa. Three species of *Tragulus* are known, one, *T. meminna*, differing from the others in being spotted. It is confined to Ceylon and southern India. The other two species are of a plain reddish or grayish color, and occur farther east, both ranging from Indochina to Malaya, Borneo, and Sumatra. The smaller species, the Kanchil, *T. javanicus*, unlike the larger, *T. napu*, also occurs on Java. The single African species, the water chevrotain, *H. aquaticus*, is somewhat larger and more heavily built than the Asiatic forms. Chevrotains are considered to be relatively unchanged survivors of the Eocene ancestors of true deer.

CHEVY CHASE, chěv'ī chās', the name of a celebrated border ballad probably founded on some actual encounter occurring between Sir Henry Percy and the Earl of Douglas, although the incidents mentioned in it are not historical. It is this ballad that Sir Philip Sidney speaks of when he says, in his *Defense of Poetry*, "I never heard the old song of Percie and Douglas that I found not my heart moved more than with a trumpet."

There are two versions of the ballad bearing the name of Chevy Chase, an older one and a more modern one. The older version is sometimes called the *Hunting of the Cheviot*, which is its original title. It begins thus:

The Persè owt of Northombarlande,
And a vowe to God mayd he,
That he wolde hunt in the mountayns
Off Chyviat within dayes thre,
In the mauger of doughte Dogles,
And all that ever with him be.

Neither the exact age nor the name of the author of this version is known. From the fact that it is mentioned in the *Complaynt of Scotland*, written in 1548, where it is called the *Huntis of the Chevot*, it is clear that it was known in Scotland before that time, and since James of Scotland is mentioned in the ballad, it may be inferred that it was not written before the reign of Henry VI, for James I did not ascend the throne of Scotland until two years after Henry VI had become king of England.

The age of the more modern version is not better known than that of the older one, but it is said to be no later than the reign of Charles I. This is the version which forms the subject of a critique by Joseph Addison in Nos. 70 and 74 of

the *Spectator*. The following is the opening stanza as given in Percy's *Reliques*:

God prosper long our noble king,
Our lives and safetyes all;
A woefull hunting once there did
In Chevy-Chace befall.

CHEVY CHASE VILLAGE, Maryland, in Montgomery County, northwest of and adjoining the District of Columbia. Established as a suburb of Washington, D.C., in 1890, it was incorporated in 1914 and governed by a board of seven elected managers, employing a superintendent of public service. In 1947 a further area was added; in 1951 an act was passed changing the name, originally Chevy Chase, by adding Village. Strictly residential, and served by a main highway, it maintains the peace and privacy of its beautiful homes. Pop. (1953) 2,300.

CHEW, Benjamin, American jurist: b. West River, Md., Nov. 29, 1722; d. Jan. 20, 1810. He studied law in Philadelphia in the office of Andrew Hamilton and later in London. He returned to Philadelphia in 1743 and held successively the offices of register of wills, attorney general and chief justice of Pennsylvania. He joined the ranks of the Loyalists on the outbreak of the Revolutionary War. The war terminated his provincial offices and he retired to private life. General Washington continued to be friendly with Chew despite the fact that he would not sign a parole. During the battle of Germantown his mansion there was badly damaged in the bombardment. From 1791 to 1808 Chew was president of the high court of errors and appeals, which was abolished in the latter year.

CHEWING GUM, a resinous gum used as a masticatory. The habit of chewing gum is perhaps peculiar to the United States. At first the resinous exudations of the spruce, cherry, etc., were employed in their native state; but with the increase of the habit the spruce supply nearly failed, and recourse was had to other ingredients. The gum resins of sweet gum, tamarack and certain other forest trees are also used. Balsam of tolu is a constituent of certain kinds of gum, while paraffin has also been employed. Paraffin is also very largely used as an adulterant in the cheaper grades of gum, which in consequence crumble when chewed. Of late years a gum known as chicle, an elastic gum from the maseberry, a tree of tropical South America, somewhat similar to the India-rubber tree (q.v.), has come into favor as the foundation of most of the chewing gum. The chicle gum is chopped into fine particles, dried and then cooked in steam-jacketed kettles. At this stage, sweetening and flavoring ingredients are added to the mass, which is mixed mechanically. The resulting "dough" is then kneaded on a table and rolled between rollers having knives set into their faces. These knives cut the sheets into suitable sizes for the market, and, after drying, the sticks are wrapped, packed and shipped. The practice of chewing gum is probably harmless, and in mild cases of indigestion it may even be somewhat beneficial, by mechanically stimulating the flow of saliva. Pepsin, mint and similar substances are often mixed in with the gum; thymol being added in the so-called antiseptic gums, but it is safe to say that the commercial success of any particular brand depends more upon its sweetness and flavor than upon any beneficial properties.

The production of chewing gum in the United States has increased at a rapid rate, and by 1949 the output of the factories devoted exclusively to its manufacture had attained an annual production worth more than \$141,250,000.

CHEWINK. See TOWHEE BUNTING.

CHEYENNE, shí-én' (Sioux, *Shahiyena*, i.e. people of alien speech or foreigners; in their own language, the name means "our people"), a tribe of the North American Algonquin linguistic family, and its westernmost member except for the Blackfeet. Their earliest known habitat was the area that became Minnesota, although the tribe took part in several great migrations, as well as the period in which they followed a nomadic life, pursuing the bison. The Cheyenne were one of the 11 major tribal groups in the western plains area. Unlike some other tribes, which formed close confederations in other places, such as the Pawnee and Iroquois League groups, the Cheyenne, like other marginal tribes, had little more than informal alliances. The tribe migrated westward along the Cheyenne River, stopping for several generations in the Black Hills, then moving on to the Platte River uplands. It was about 1830 that they formed two bands, a northern group and a southern.

The Cheyenne had a typical plains culture and history. According to the tribal tradition, they had lived originally in a very cold climate, where they were an agricultural people, cultivating corn and other crops. They also knew how to fashion pottery; but these arts were lost when the tribe became roaming buffalo hunters and nomads, roving the plains between the Arkansas and Missouri rivers.

Generally speaking, the Cheyenne had been friendly toward United States settlers, concluding certain treaties with them, but in 1861 the southern branch began hostilities because of the numerous violations by United States forces and settlers of agreements made with the Indians. In 1864 the Sandy Creek, Colorado, massacre took place, where the United States Army slaughtered Indian warriors, women and children alike. This action infuriated the Cheyenne who instigated one of the most bitter of the Indian wars. In 1868 Custer's victory on the Washita River, destroying the Indian camp, ended the hostilities. The history of the northern Cheyenne has been more peaceable.

The Cheyenne are a tall people, perhaps the tallest of the Great Plains groups. They are a well-built race. Their language is one of the most difficult of the Indian tongues, although the Cheyenne speech is closer to the central Algonquin dialect than are those of some of the other tribes. The Cheyenne still maintain, in the reservation, their complex social organization. They live in tepee, observe the rite of the Sun Dance and other tribal ceremonies.

The first treaty between the tribe and the United States was in 1825. The locale was the mouth of the Teton River, South Dakota; tribal recognition and provisions for trade were established, but no reservation was designated. After the tribal schism into northern and southern branches, the new southern section formed a confederacy with their Algonquin kinsmen, the Arapaho, along the Arkansas River. Unfortunate incidents with the United States Army and settlers ensued and there were many treaty violations, but

in 1892, the present reservations in Montana and in Oklahoma were accepted.

The Cheyenne and Arapaho languages were so different, that the two tribes became very proficient in the sign language in their intercourse with each other. These two tribes are perhaps most proficient in this language.

Consult Grinnell, George B., *The Cheyenne Indians*, 2 vols. (New Haven, Conn. 1923); Peter, R. C., *Reminiscences of Past Years in Mission Service Among the Cheyenne*, 1st ed., paper bound (Lame Deer, Mont. 1936); Llewellyn, Karl N., and Hoebel, E. A., *Cheyenne Way* (Norman, Okla. 1941).

C. ROSS HUME,
Attorney at law, Anadarko, Okla.

CHEYENNE, shi-én', city, Wyoming, is the capital of the state and seat of Laramie County. It is in the southeastern part of Wyoming on a plateau 6,060 feet above sea level, and is 106 miles north of Denver. Just west of the city is Medicine Bow National Forest. Cheyenne is served by the Union Pacific, the Colorado and Southern, and the Burlington railroads. The city has good airline connections from its municipal airport which is equipped with large airplane repair shops. Cheyenne lies at the intersection of three transcontinental highways, and a three-mile boulevard extends northwest from the city to the Francis E. Warren Air Force Base. Near this base are the Pole Mountain Maneuver Grounds of the United States Army. Coal, iron, oil, and other mineral deposits are worked in the vicinity of Cheyenne, and dry farming and cattle and sheep grazing are large and important industries. Cheyenne ships beef cattle (especially Herefords) and sheep to eastern markets, and is an important wholesale trade center. Among its newer industries are oil refining and airplane tool manufacture. There are good winter sports in the Pole Mountains and Snowy Range west of the city, and Cheyenne is the supply depot for much of the game hunting and sport trade of the Rocky Mountains.

The city is administered by three commissioners (elected every two years) under the commission form of government. There is a municipal system of waterworks which cost 5½ million dollars. Cheyenne is attractively laid out with broad streets and boulevards, and its public parks and ornamental lakes cover 800 acres. Annually, during the last full week in July, Frontier Park is the scene of the Frontier Days celebration which provides the largest wild West show of its kind in the world and includes a pageant of transportation and a rodeo. Since 1897, when it was instituted, it has attracted thousands of visitors. The city's buildings of special interest are the state capitol, the State Office Building, the federal building and post office, the governor's mansion, the city hall and county courthouse, the state supreme court building (with a fine reference library), a veterans' hospital, a Carnegie library, the Industrial Club, the Union Pacific Station, the Convent of the Holy Child Jesus, and St. Mary's Catholic Cathedral.

History.—Cheyenne was named after a tribe of Algonquin Indians of the west. It was founded in 1867 when the Union Pacific Railroad reached this point in its westward building, and was incorporated in 1869. A fort was built to protect the railroad workmen and settlers. The Union Pacific established its main repair shops there, which, with yards for the division, now occupy a 470-acre tract. In 1868, Cheyenne was made

the seat of Laramie County and the following year it was selected as the capital of Wyoming Territory, maintaining that position when Wyoming became a state (Cheyenne still holds its position as temporary capital. A referendum submitted to the voters, as required by the state constitution to determine a permanent capital, has failed to give any Wyoming city a majority of the votes cast). Cheyenne boomed as an out-fitting point for miners and as the center of a great cattle empire. From its beginnings, its strategic location in transcontinental transportation was the major factor in its growth. Between 1870 and 1900, population increased from 1,450 to 14,087; and in 1950, reached 31,935.

CHEYNE, chān, **George**, Scottish physician: b. Methlick, Aberdeenshire, 1671; d. Bath, England, April 13, 1743. He started a London practice about 1702, and shortly after was elected a fellow of the Royal Society. His health began to fail, perhaps as a result of his free living. He derived so much benefit from strict adherence to a milk and vegetable diet that he recommended it in all his later medical treatises, which included *New Theory of Fevers* (1702); *Philosophical Principles of Religion* (part 1, 1705); *Essay of Health and Long Life* (1724); and the *English Malady* (1733).

CHEYNE, Thomas Kelly, English Biblical scholar: b. London, Sept. 18, 1841; d. Oxford, Feb. 16, 1915. He was educated at Merchant Taylors' School, Worcester College, Oxford, and spent some time at Göttingen where he heard Georg Heinrich Ewald lecture. In 1868 he was elected fellow of Balliol College and from 1885 to 1908 he was Oriel professor of the interpretation of Scripture at Oxford. In 1884 he became a member of the Old Testament revision board. His numerous works deal exclusively with the exposition and criticism of the Old Testament books, the most important of which was his joint editorship, with J. Sutherland Black, of the *Encyclopaedia Biblica*, 4 vols. (1899–1903).

CHEYNE, Sir William Watson, English surgeon: b. off shore, near Hobart Town, Tasmania, Dec. 14, 1852; d. Fetlar, Scotland, April 19, 1932. He was educated at Edinburgh University and was Hunterian professor of the Royal College of Surgeons of England, 1888–1890, and its president, 1914–1917. He was created baronet in 1908. He published *Antiseptic Surgery* (1882); *Manual of the Antiseptic Treatment of Wounds* (1885); *Manual of Surgical Treatment*, 7 vols.

CHEYNE-STOKES RESPIRATION, an irregular breathing common in severe cases of diseases of the heart, kidneys, or cerebral affections. The respirations occur in a cycle, increasing rapidly then decreasing, finally reaching a point of total cessation for from 5 to 50 seconds. After a pause, the cycle begins all over again. Such a state usually presages death.

CHEYNEY, chā'nē, **Edward Potts**, American educator and sociological writer: b. Wallingford, Pennsylvania, Jan. 17, 1861; d. Feb. 1, 1947. After graduating from the University of Pennsylvania in 1883, he took a postgraduate course there, and later traveled abroad, studying in German universities and at the British Museum. Upon

his return he was appointed professor of European history in the University of Pennsylvania. He has written *Social Changes in England in the 16th Century* (1896); *Social and Industrial History of England* (1901); *A Short History of England* (1904); *Background of American History* (1905); *Readings in English History* (1908); *A History of England, from the Defeat of the Armada to the Death of Elizabeth* (1914).

CHEZY, shā-zē, Antoine Leonard de, French Orientalist: b. Neuilly, France, Jan. 15, 1773; d. there, Aug. 31, 1832. He began his studies in the École Polytechnique, and, unassisted, taught himself Sanskrit, and became so proficient in it that, in 1815, a chair of Sanskrit was formed expressly for him in the College of France. Among his productions is a free French translation of the Persian poem, *Medjoun et Leila*. He also published Kalidasa's drama of *Sakuntala*, in the original, with a translation accompanied with notes.

CHHATTISGARH, chūt' ēs-gār, Indian Union, the southeast division of the Central Provinces, comprising formerly the districts of Raipur, Bilaspur and Sambalpur, and several small feudatory states. In 1906 Sambalpur was given to Bengal, and the district of Drug constituted out of parts of Raipur and Bilaspur. Its area is 37,688 square miles. It is mainly a vast fertile plateau, and has of late become a great center of the Indian grain trade. Dongargāon is the capital. Pop. (1941) 4,050,000.

CHIABRERA, kyā-brā'rā, Gabriello, Italian lyric poet: b. Savona, June 8, 1552; d. Savona, Oct. 14, 1637. Impatient of dependence on the great, he again and again abandoned the courts of noble patrons. He visited Rome and resided a considerable time at Florence and Genoa, settling finally in his native place. Wherever he went he was loaded with presents and honors. Pindar and Anacreon were his models among the poets, and his countrymen named him "the Italian Pindar," but his Pindaric odes have little grace and force, being labored rather than spontaneous. Some of his little songs after Anacreon are models of elegance and grace. He wrote epic and dramatic poems also. He showed himself a master of complex rhythms, ambitious and new in form, and a master of the Italian language such as had never before appeared. He was the last of the great Italian writers until the appearance of Manzoni in modern times. He left a charming autobiographical sketch. His collected poems were published under the title of *Rime*.

CHIANA, kyā'nā, (the ancient CLANIS) a river of central Italy, originally a tributary of the Tiber, watering a perfectly level valley, which its overflow rendered once the most pestilential district of Italy. The bed was deepened in 1789-1816, and in 1823 extensive hydraulic works were undertaken for further improving the river course, and for leading a north branch, through canals, to the river Arno, a few miles below Arezzo, the south stream reaching the Tiber through the Paglia at Orvieto. The double stream is 60 miles long, and one-half to one mile broad, and the district has since become one of the most fruitful in all Italy.

CHIANG KAI-SHEK, jē-āng' kī'shēk', Chinese statesman and general: b. Chikow, District of Fenghwa, Chekiang Province, China, Oct. 31, 1887. He received his military training at the Chinese military academy at Paoting, and the Tokyo Military College, being graduated from the latter after a four-year course. While in Tokyo he became an adherent of Dr. Sun Yat-sen, and upon his return to China he joined the Kuomintang, or People's Party. He participated in the Revolution of 1911 and the establishment of the Chinese Republic, and was thereafter closely associated with Doctor Sun, taking part in minor civil wars and the quelling of various insurrections until 1916, when he engaged temporarily in business. He returned to his service with Sun in 1920, and later was sent to Soviet Russia to study military methods, after which he was appointed head of the Whampoa Military Academy. He became commander in chief of the army in 1925, after the death of Doctor Sun, and in 1926 first came into international prominence through his successful expedition against the war lords of Northern China. He broke relations with the Communists in China and rid himself of the Russian Soviet advisers of the Sun era in 1927, establishing the capital at Nanking; resigned in August of that year, but was recalled again to lead the army early in 1928, and afterward marched northward and occupied Peiping. He was president of China's Nationalist government in 1928-1931, as well as commander in chief of its army, but again withdrew from office, in the hope of eliminating dissension among party groups, and was succeeded in the presidency by Dr. Lin Sen. Reappointed to command the army in 1932, he continued to make civil war against the Communist groups. In 1936, however, disaffection in the northern armies and the forces under the "Young Marshal," Chang Hsueh-liang, led to the kidnapping of Chiang, who was held for two weeks at Sian in undoubted peril of his life. Thanks to skillful mediation, a settlement was reached whereby it was agreed that the Communist issue should await settlement as a political problem, while the country faced the Japanese menace united under Chiang's leadership.

Upon the outbreak of war with Japan in 1937 he assumed full command of Chinese military activity; and from China's declaration of war against Germany and Italy, Dec. 8, 1941, he was continuously a member of United Nations military councils until the end of the war.

In 1943 he was again made chairman of the Executive Yüan of the Nationalist Government (provisional president), and represented China at the Cairo Conference. On the successful conclusion of the war with Japan, Chiang returned to Nanking with the object of rebuilding the country and crushing the Communists. On May 20, 1948, he was sworn in as China's first constitutional president. However, unable to stem the tide of Communist victories, he retired from office on Jan. 21, 1949, turned over the reins of government to Vice President Li Tsung-jen, and left Nanking. In May he flew to Formosa and began organizing the island as a last defense bastion for the Nationalist cause. Continuing Communist victories motivated his announcement on March 1, 1950 that he was resuming the presidency.

His second wife, MEI-LING, or MAYLING, Soong, to whom Chiang was married in 1927, was

born in Shanghai in 1898, and was graduated from Wellesley College in 1917. Shortly after their marriage Chiang became a Christian (Methodist) convert. Mme. Chiang, inspired by democratic and Christian ideals, worked for the welfare of the Chinese people, and during the war years she played a leading role in national defense and international diplomacy, spending much time in the United States in an endeavor to secure greater aid for China. She joined her husband in Formosa in 1950. Her published works include *China in Peace and War* (1940); *This Is Our China* (1940); and *China Shall Rise Again* (1941).

CHIAPANECs, chē-ā-pā-nēks', or **CHAPANECs**, a tribe of Indians of central Chiapas, Mexico. They are supposed to have entered Mexico much earlier than the Aztecs, from whom they borrowed part of their religion and culture. They were also influenced by the Mayas of Yucatan and northern Guatemala. Although they were able to escape Aztec domination, they were easily conquered by the Spaniards. Remains of the old Chiapanec civilization have been excavated at El Sumidero, San Pedro Buenavista, and other sites.

CHIAPAS, chyā'pās, state, Mexico, situated on the Pacific coast, between the Isthmus of Tehuantepec and Guatemala, with an area of 28,729 square miles. The capital is Tuxtla. Inland from the coastal plain rises the Sierra Madre del Sur. The state is well watered by the Usumacinta and Grijalva rivers and their tributaries. In the north, at Palenque, are celebrated Maya ruins. The fertile valleys produce henequen, coffee, tobacco, corn, sugar, cotton, and fruit, and the forests yield ebony, cedar, and mahogany. Cattle, sheep, and hogs are raised. A branch of the National Railways of Mexico runs parallel to the coast, and the Sureste Railway crosses the northern part of the state. Pop. (1950) 907,026.

CHIAROSCURO, kī-ā-rō-skū'rō (Ital. *chiaro*, light + *oscuro*, dark), a term used in painting with reference to the distribution of lights and darks, and extended to art criticism in general as the harmonious blending and composition of light and shade effects. Although the problem of chiaroscuro appears in varying degrees in all periods of the history of art, it is the subject of particular attention in Leonardo da Vinci's *Treatise on Painting*, in which he observes that the intensification of light and shadow strengthens the relief effect (modeling) of the forms, but also adds beauty through the interpenetration of light into the shaded areas and shadows into the lighted sections of the painting. These effects appeared in his own paintings, and became even more prominent in the work of Il Giorgione and the colorists of the north Italian schools. A penetrating realism combined with a strong, almost theatrical use of light and dark became the distinctive feature of Michelangelo da Caravaggio and his followers in Italy, Spain, France, and the Netherlands during the 17th century. The most outstanding master of chiaroscuro is Rembrandt, whose use of light as a means of modeling forms and creating the illusion of a free-flowing space around them was combined with a sensitivity that made light an expressive medium in its own right. Though most dramatic in his painting, as in *The Night*

Watch, the effect is consistently carried through his drawings and graphic work, which have become the principle sources for the inspiration of 19th and 20th century specialists in chiaroscuro.

CHIAVARI, kyā'vā-rē, commune, Italy, situated in Genova Province, Liguria, on the Gulf of Rapallo, 22 miles east-southeast of Genoa. A resort and market town, it has food-processing plants, tanneries, and establishments producing silk, lace, linen, furniture, and ships. There are attractive public gardens, a museum, and a cathedral built in 1613. Pop. (1951) 20,324.

CHIAVENNA, kyā-vā'nā, commune, Italy, situated in Sondrio Province, Lombardy, on the Mera River, at the north end of Lake Como, 25 miles west-northwest of Sondrio. A tourist center at the junction of the Splügen and Maloja passes leading through the Alps to Switzerland, it produces skis, shoes, woolen cloth, stoves, and beverages. Pop. (1951) 6,039.

CHIBA, chē'bā (Jap. chē-bā), city, Japan, capital of Chiba Prefecture, Honshu, situated on Tokyo Bay, 20 miles east of Tokyo. It has a medical school and an 8th century Buddhist temple. Paper, cotton goods, and processed food are produced. Pop. (1950) 133,844.

CHIBCHAS, chīb'chās, or **MUYSKAS**, mwēs'kās, the native population of the high plateau of Bogotá in central Colombia at the time the region was discovered by Europeans. The Chibchas were a farming people, cultivating corn, potatoes, quinoa, and a long list of other native Andean food crops. They lived in towns, some of them of considerable size; Chibcha Bogotá, for example, is reported to have contained 20,000 houses. The buildings in these towns were constructed of wood, with walls of cane and mud, so that they have not produced the spectacular ruins found in areas like Mexico and Peru. The Chibchas wove cotton cloth for clothing and made jewelry of gold and emeralds.

Politically, the Chibchas were organized in many small city-states, often at war with one another. In the early 16th century A.D., the Zipa dynasty of Bogotá under Nemequene and his nephew, Tisquesusa, built up a powerful feudal state in the southern third of Chibcha territory. The rival Zaque dynasty at Tunja provided the major opposition, but there were a number of lesser rulers involved as well. The Zipa maintained considerable state and enjoyed absolute power in his dominions.

Chibcha religion was rich in mythology, in ceremonies, and in organization. A number of the chief gods were nature deities, of whom the Sun was one of the most important; human sacrifices were made to him. Other deities received offerings of gold, emeralds, incense, corn, beer, and other prized materials. Fasting and ritual bathing were practiced, and public ceremonies included imposing processions. There was a professional celibate priesthood, and the Chibchas recognized a high priest of the entire nation named Sugamuxi.

The Chibchas were conquered by Spanish armies between 1536 and 1541, and their religion and native political organization were soon suppressed. The Chibcha language became extinct in the 18th century, but the descendants of the Chibchas, numbering over a million, still form the

basic rural population of their original homeland.

Consult Kroeber, A. L., "The Chibcha," *Handbook of South American Indians*, Bureau of American Ethnology Bulletin 143, vol. 2, pp. 887-909 (Washington 1946); Pérez de Barradas, José, *Los Muiscas antes de la conquista*, 2 vols. (Madrid 1950-51).

JOHN HOWLAND ROWE,
University of California, Berkeley.

CHIBOUQUE, *chí-bōōk'*, **CHIBOUK**, **CHIBUK**, a long Turkish pipe having generally a wooden stem, an amber mouthpiece and a clay bowl. The stem, which is usually from four to five feet long, is generally wound with silk, cotton or other thread. This is frequently kept wet to cool the smoke of the pipe by evaporation.

CHICA, *chē'kā*, **PITO**, *pē'tō*, or **POSO**, a kind of beer made from maize, in general use in Chile, Peru and other mountainous regions of South America. It was the national drink of the natives long before the appearance of the Spaniards. The most ordinary method of preparing it is to steep the grains of maize until they begin to sprout, when they are exposed to the sun. The malt thus prepared is then ground, mixed with warm water and left to ferment. The beer, when ready, has a dark-yellow color and a pleasant and somewhat bitter and sour taste. It is consumed by the Indians in great quantities. When Chica has been buried for some time in the earth in pitchers it has a violently intoxicating effect.

Chica is also an orange-red coloring matter prepared by the Orinoco Indians from the leaves of a plant called *Bignonia chica*.

CHICACOLE, *chik-a-kōl'*, or **CICACOLE**, India, a town in the Ganjam district, Madras Presidency, near the coast, about 567 miles northeast of Madras, at one time famous for its fine muslin manufactures. On two occasions, namely in 1791 and 1866, it suffered much from famine, and in 1876 a flood did considerable damage to the town. Pop. (1941) 22,250.

CHICAGO, county seat of Cook County, Illinois; a port of entry; largest city in the state, and second largest in the country; located on the west shore of Lake Michigan near its southern tip. The city is the greatest rail center in the world; is a major industrial, commercial, and financial center, and dominates a metropolitan area that extends into northern Illinois and Indiana, southeastern Wisconsin, and southwestern Michigan. Rail, motorbus, air, and boat lines connect the city with every part of the United States and give access to all American seaports.

Geography.—The city stands on a low, remarkably flat lake plain whose loose, gravelly, and sandy soils lie deep over the bedrock. The evenness of the region has made drainage difficult, while the heavy overlay of surface materials has challenged engineering skill in building construction. The Chicago River, formerly emptying into Lake Michigan but now an outlet for the lake, flows westward about one mile from the lake shore and then separates into its north and south branches. This river system creates the principal divisions of the city: the South Side, lying between Lake Michigan and the main river and its south branch; the North Side between the lake and the main river and its north branch; the West Side, between the river branches and

the western city limits. In the extreme southern portion of the city is Lake Calumet, a shallow body of water, connected northeastward to Lake Michigan by the canalized Calumet River, and westward to the Mississippi Valley watershed by the Little Calumet River and the Calumet Sag Channel. The Loop, narrowly defined, is that section bounded by Lake, Wells, and Van Buren streets and Wabash Avenue, above which the elevated trains into the city loop (hence the name) before beginning their return trips to the outlying sections. In common parlance, the Loop refers to the somewhat larger, but less definitely marked off, main business section. It may be considered to comprise the area bounded by the river on the north and west, Van Buren Street on the south, and Michigan Avenue on the east. The incorporated area of Chicago is 212.8 square miles. The official elevation at the lake is 579.88 feet above sea level, the gentle westward rise of the land from the water's edge giving the city an average elevation of about 600 feet. Average temperatures are 25.7°F. for January and 73.9°F. for July; the average annual precipitation is 31.85 inches.

Population.—Chicago did not appear in the federal census until 1840, at which time it had a population of 4,470 and ranked 54th among the country's cities. In 1860, the Chicago population reached six-digit proportions, its 109,260 inhabitants bringing the city into 8th place among urban centers. With the 1880 count, Chicago passed the half-million mark; and, in 1890, the million. In subsequent enumerations the population has been: 1,698,575 (1900); 2,185,283 (1910); 2,701,705 (1920); 3,376,438 (1930); 3,396,808 (1940); 3,620,962 (1950). Since 1890, Chicago has been outranked among American cities only by New York. The city has grown by influx from other regions of the United States and from abroad, and by annexation of neighboring communities.

Chicago's population is an amalgam of virtually every ethnic and racial strain. While this population of diverse origins results in tensions and stresses that constitute a major problem, the city is indebted to its various component groups not only for the contribution of sheer manpower which each makes, but for contributions of color, variety, and cultural enrichment. Next to the phenomenal growth of numbers, perhaps the most significant change through the years in Chicago's population has been the increasing numerical preponderance of the native-born, white element. In 1870, this group made up only half of the total population; by 1940, it had risen to nearly three fourths. Another significant development has been the sharp increase in the number of Negro citizens. The intense economic activity which accompanied each of the world wars opened opportunities to which the Negro responded by large-scale immigration to the city. By 1940, Chicago had 324,102 Negro inhabitants (30,150 in 1900), most of whom lived on the South Side in an area roughly rectangular in shape, with South Parkway as its major axis.

Transportation.—No city in the world surpasses Chicago as a railroad center. Chicago is served by 19 major trunklines. The large downtown terminals are supplemented by numerous neighborhood and suburban stations in the handling of passenger traffic; and extensive switching yards, belt lines, and freight subways care for the vast volume of goods that enter and leave the

city each day. Though there had been agitation for the consolidation into one location of all passenger terminals, these facilities still remained dispersed in 1950, the principal ones being the Dearborn, Central, Grand Central, Union, La Salle Street, and North Western stations.

Chicago is a major aviation center. Passenger arrivals and departures averaged nearly 200,000 per month at the end of 1949. Passenger, express, and freight service is supplied by over 30 airlines. The most important airfields are those operated by the aviation bureau of the city: Municipal Airport on the South Side; Meigs Field on the lake front, and O'Hare Field on the city's northwest perimeter. Municipal Airport (1928, first full year of operation) is equipped with all modern facilities and safety devices. An observation deck on the terminal building, open to the public, provides a vantage point from which the field's activities may be surveyed. In 1950, O'Hare Field (called Douglas until June 22, 1949) was in an early stage of the \$3,100,000 development provided for by the Illinois legislature. Numerous auxiliary fields are located in the Chicago area.

The provision of adequate internal transportation facilities for the city's millions can fairly be termed Chicago's greatest problem. The basic street pattern is a severely rectangular grid of north-south and east-west streets cut across by a few diagonal avenues, and supplemented by a belt of outer drives running north-south along the lake front. Approximately 70,000,000 persons a month ride the elevated trains, street cars, trackless trolleys, and street buses operated by the municipally owned Chicago Transit Authority. Taxis and privately owned buses augment the CTA's carriers. Obvious inadequacies of internal transport led to the creation, in November 1938, of a department of subways and superhighways. Under the direction of this department, the city embarked on an ambitious program designed to alleviate traffic congestion. One part of the program involved depressing a portion of the elevated trackage beneath the ground surface into a series of subways. The other part called for construction of a network of superhighways radiating from the central business district and interconnected by a crosstown route. Operation of the first section of the subway system (cost \$34,120,000) was inaugurated Oct. 17, 1943. Tiled walls, fluorescent lighting, escalators, and conveniently arranged exits and entrances made the underground stations both striking in appearance and highly functional. The west route of the superhighway system was farthest advanced in 1950. In the business district, sidewalks were to be passed by arcades through the buildings flanking Congress Street, over which the highway passes, to permit extension of the roadway to a width of 68 feet.

Thousands of workers and shoppers pour into the city each morning on the commuter trains of various railroads and return at late afternoon to their suburban homes. The Illinois Central is Chicago's largest commuter carrier, and second largest in the United States; its suburban lines were electrified in 1926.

Industry and Commerce.—The Chicago industrial area is one of the marvels of American economic life. Favored by central location, an abundance of level land, inexhaustible water supply, ready access to great coal fields and iron deposits, and strategic relationship to the Great

Lakes and Mississippi Valley waterways, the city has maximized these natural advantages by application of a vigorous business and civic leadership and the skills of an able labor force. The primacy of industry in Chicago's economy is shown by the fact that in 1949 more of the gainfully employed were to be found in manufacturing (43 per cent) than in the next three fields combined (trade, 21 per cent; service establishments 12 per cent; transportation, communication, public utilities, 9 per cent). This industrial area leads all others in the production of worked metal products, commercial printing, meat and packinghouse products, telephone equipment, cosmetics and soap, radio and television apparatus, confectionery, electrical equipment, and many other kinds of goods. Over 12,000 establishments produced 11 billion dollars worth of manufactured goods in 1949.

Meat packing has long been the city's leading and most distinctively characteristic industry. The West Side stockyards cover hundreds of acres, and receive a constant flow of live animals for sale or reshipment. The packinghouses are noted for converting "everything but the squeal" into usable products.

Chicago is famed also as the great grain-trading center of the United States. It has elevator warehouses in which vast quantities of wheat are held and a world market for cereal grains in the Board of Trade Building at Jackson Boulevard and La Salle Street. As Wall Street in New York regulates trade in securities, so La Salle Street in Chicago directs trading in grain. The "pits," as the trading posts of the board of trade are called, are scenes of feverish activity as brokers negotiate the purchase and sale of millions of bushels of grain for immediate or future delivery.

The Chicago area became a major center of American steel production with the expansion, after 1900, of the industry on the shorelands in southern Cook County and adjacent Lake County, Indiana. As in the case of the livestock and grain industries, so too for steel has strategic location been a decisive factor. Transportation facilities for handling the basic raw materials—ore, fuel, and limestone—plus a steady and diversified labor supply have resulted in a producing center of tremendous capacity. Steel-fabricating plants quite naturally have associated themselves with this source of supply. Worked steel comes from these factories in every conceivable form, from railroad rails and structural shapes to bolts, nuts, rivets, and washers.

Wholesale trade is nearly as important to the city as its industrial output. Buyers are attracted by such permanent institutions as the Merchandise Mart and the Furniture Mart, and by numerous trade shows and fairs held every year. The retail trade derived from Chicago's own inhabitants and visitors to the city is augmented by the mail-order business for which Chicago is noted. Aaron Montgomery Ward pioneered in this field with his North Clark Street establishment in 1872; and Richard Warren Sears, after earlier business ventures, founded Sears, Roebuck & Company in 1893. Retail selling by mail partly accounts for the fact that more domestic money orders and more parcel post packages are handled by Chicago post offices than by those of any other city.

The existence of Chicago as a lake port, to speak rather fancifully, antedated its existence as a town, for the Indian used the city's present

site as a landing place for his canoe long before the white man came. From Chicago's earliest days, access to the outside world by way of Lake Michigan's waters has been an important asset. Existence as a Mississippi Valley port is of much more recent origin. The Illinois-Michigan Canal, completed in 1848, connected the Chicago River with the Illinois, a tributary of the Mississippi. This canal was superseded by the Sanitary and Ship Canal (1900) joining the Chicago River and the Des Plaines, a branch of the Illinois. Further improvement of the Des Plaines and Illinois rivers made possible the opening in 1933 of the Illinois Waterway, giving Chicago a through water route to the Mississippi, and thence to the Gulf of Mexico. The city's principal docks are at Calumet harbor, in the Calumet River, along the south branch of the Chicago River, and at Navy Pier which juts into the lake just north of the river's mouth. Navy Pier and Calumet harbor are protected by extensive breakwaters. In 1949, water-borne traffic handled by harbors in the Chicago area amounted to nearly 49,000,000 tons; a little over one-half was reported at the Port of Chicago, and most of the remainder at the steel ports of Gary and Indiana Harbor.

Two private corporations, the Commonwealth Edison Company and the Peoples Gas Light and Coke Company, supply electricity and gas, respectively. The Illinois Bell Telephone Company had nearly a million and a half phones in active service in 1950.

Buildings.—Chicago can be justly proud of much that has been built; of some, it is duly ashamed. A city of steel and concrete, brick and tile, replaced the wooden city that stood before the Great Fire of 1871. In the Loop and on the Near North Side cluster towering skyscrapers, monuments to engineering skill and financial acumen. Office buildings, huge department stores, and capacious hotels characterize the downtown section. Outlying neighborhoods have grown into cities within the city proper. But, in 1950, mingled with imposing business edifices and the attractive homes and apartment hotels of the well-to-do were the city's slum areas. While progress was being made, the slum-clearance program had much before it in the form of challenge.

Noteworthy among public buildings are the City Hall-County Building and the United States Court House (1905) in the Loop. The former, though named as one building, is actually two. The county's half was built in 1907; the city's, in 1910. State Street is marked as the heart of the retail merchandising section by such department stores as Marshall Field & Company; Carson, Pirie, Scott & Company; and The Fair. Randolph Street is Chicago's "Broadway," and La Salle Street is its "Wall Street." To the later thoroughfare the massive buildings of financial institutions impart a decidedly substantial, if somewhat somber, air. Throughout the Loop and in its immediate environs are found such noted hotels as the Stevens (still the world's largest in 1950), the Palmer House, the Sherman, the Morrison, and the Blackstone.

Chicago is the home of the skyscraper. When William Le Baron Jenney built the Home Insurance Building (1884-1885) and William Holabird the Tacoma Building (1887-1888), no other city in the world had seen the steel-skeletoned structure that is now so familiar. By 1930, the city boasted 32 buildings over 300 feet tall. Since World War I, skyscraper construction has been

concentrated on the Near North Side and along Wacker Drive. Notable for beauty are the Wrigley Building, bathed at night by floodlights; the Tribune Tower, with its flying buttresses; and the Palmolive Building, atop which shines the Lindbergh Beacon. All these are on North Michigan Avenue. Facing the north shore of the river near its fork is the Merchandise Mart (1930), a 24-story structure of reinforced concrete faced with Indiana limestone. Here manufacturers and wholesalers display goods to buyers, and literally thousands of "lines" are shown. Wacker Drive is a double-decked boulevard built during the administration of Mayor William E. Dever (1923-27). Roughly L-shaped, the drive extends for seven blocks along the southern shore of the main river, then turns at the forks and continues southward for an additional four blocks. At its southern tip stands the Civic Opera Building, completed at a cost of \$20,000,000 in 1929. The gala opening of the Civic Opera, Jan. 29, 1929, was a milestone in Chicago's history, as it marked the abandonment of the old Auditorium where forty years before Adelina Patti's Juliet had thrilled those gathered for the opening of that hall. The Auditorium (acquired by Roosevelt College in 1947) was designed by Louis Henri Sullivan and Dankmar Adler, and its acoustical perfection made it the marvel of its day. Among other buildings worthy of note are: Orchestra Hall (1904), financed partly by residents of the city as a memorial to the great conductor, Theodore Thomas, who was director of music at the World's Columbian Exposition (1893) and conductor of the Chicago Symphony Orchestra, 1891-1905; the American Furniture Mart, on Lake Shore Drive, a wholesale marketing center; the Daily News Building (1929), the first in Chicago whose construction involved the purchase of air rights.

Education.—Chicago is, as befits its size and central location, one of America's great educational centers. The public school system, with hundreds of buildings, hundreds of thousands of students, and millions of dollars invested, is administered by a board of education whose members are appointed by the mayor. Following the standard American system, its organization includes elementary and high schools, junior colleges, special schools for handicapped children, night schools, vocational schools, and a teachers college. Instruction is designed to coordinate routine studies and exercises with development of mental initiative and practical training. The parochial school system is organized on a scale commensurate with the size of the city, and comprises elementary schools, high schools, and academies.

In the field of higher education, Chicago is outstanding. The University of Chicago (1890) is a world-renowned center of research and instruction. Northwestern University (1851), located in the north shore suburb of Evanston, maintains many of its professional schools at the Chicago campus on the Near North Side. The Illinois Institute of Technology was established in 1940 by the merger of two older schools, Armour Institute of Technology (1892) and Lewis Institute (1896). Roosevelt College, founded in 1945, occupies the former Auditorium Hotel on Michigan Avenue. The University of Illinois maintains in the city an undergraduate branch on Navy Pier, as well as its colleges of dentistry, medicine, and pharmacy. Among Catholic institutions are DePaul University (1898), Loyola

University (1870), Mundelein College (1930), and Rosary College (1922) in suburban River Forest. Rush Medical College (now the Rush Graduate School of Medicine of the University of Chicago) was a pioneer in its field when it was incorporated in 1837. Other institutions abound which offer training in the mechanical arts and allied subjects, nursing, physical and occupational therapy, business and commerce, and almost countless other fields.

Cultural Institutions.—The Chicago Natural History Museum, formerly the Field Museum (1893), is housed in a majestic building of white Georgia marble at the south end of Grant Park. The museum is one of the world's great scientific institutions, engaged in both the collection and diffusion of knowledge. Its comprehensive exhibits are arranged in four major classifications: anthropology, botany, geology, and zoology. The scope and variety of the museum's work are such that it serves layman and specialist alike. Its program includes the support of research expeditions, publication of scientific treatises, lectures, and radio programs, in addition to the maintenance of its public exhibits. Its facilities are extensively used by faculty and students of the city's colleges and universities. The exhibits of the Museum of Science and Industry, in Jackson Park, illustrate the contributions of applied science to human life. The fact that its exhibits work—that, indeed, they may be manipulated by the visitor himself—increases their effectiveness and fascination. Especially popular are the operating coal mine, iron foundry, and oil refinery, and exhibits illustrating such modern wonders as radar and atomic fission. The Chicago Academy of Sciences (1857) in Lincoln Park has a splendid collection of Americana, particularly along lines relating to Chicago and the Middle West. Its exhibition halls are open to the public without fee, and the academy publishes scientific papers from time to time. The Adler Planetarium building (1930) at the south end of Grant Park houses the planetarium instrument and an astronomical museum. Nearby is the John G. Shedd Aquarium (1924) with approximately 350 species of fresh- and salt-water fishes and other aquatic animals from every quarter of the earth.

The Chicago Historical Society (1856) has expanded its exhibits from a small case of "antiques and relics" in 1858 to an irreplaceable, and hence literally priceless, collection that fills the galleries of its home in Lincoln Park. Its library and museum are treasure houses of national and local historical lore. Lincoln Hall contains many personal possessions of the martyred president. A collection of more than 4,500 costumes portrays American dress from the 18th to the 20th century. The Art Institute of Chicago (1882), on the Michigan Avenue side of Grant Park, is an outgrowth of the older Chicago Academy of Fine Arts (1879). The institute has permanent collections of the highest quality, and exhibitions of loan collections are frequently held. Such artists as Lorado Taft, Frank Duvenek, and George Bellows have taught in the institute's school of fine arts. Courses in industrial and dramatic arts are also given. The foregoing seven institutions are located in parks governed by the park district commissioners, but all except the Adler Planetarium have their own boards of trustees.

Chicago is amply endowed with libraries. The Chicago Public Library (1872) had its beginning

after the fire of 1871 in a collection of over 8,000 books sent by sympathetic English friends of the city. Chiefly responsible for this benefaction was Thomas Hughes, author of *Tom Brown at Rugby*, and among the donors was Queen Victoria. After occupying in succession four locations (the most unique being an abandoned steel water tank), the central library opened its doors on Oct. 9, 1897 at the present location between Washington and Randolph streets on Michigan Avenue. Auxiliary to the central library are numerous branches and subbranches throughout the city. Two privately endowed libraries are famed throughout the world of scholarship. The John Crerar Library (1897), opposite the public library on Randolph Street, is devoted to the natural and social sciences. Newberry Library (1887) on the North Side emphasizes the humanities. The city maintains a Municipal Reference Library where public records may be consulted. The Midwest Library Center serves as a pool in which member institutions may deposit their little-used volumes, thus relieving the strain on their own facilities. The Library of International Relations (1932) on the Near North Side specializes in foreign newspapers, magazines, and official documents. The libraries of the two universities and of the smaller colleges contribute to Chicago's cultural resources, as do those of the various museums and other institutions.

Recreation.—A wide variety of spectator sports may be enjoyed at every season of the year. Comiskey Park (1910) on the South Side is the home of the American League White Sox, and Wrigley Field (1914) on the North Side is used by the National League Cubs. These parks are the scenes of professional football, wrestling, boxing, and other contests in addition to their major league baseball games. Soldier Field at the south end of Grant Park is a gigantic stadium used for festivals and public gatherings as well as for athletic contests. The Chicago Stadium (1929), west of the river on Madison Street, is an indoor arena where hockey, basketball, tennis, and other types of sporting events are held. Numerous other halls, stadia, and fields hold similar contests. The colleges and high schools of the city have their enthusiastic followers, and their athletic squads contest before large crowds. The city parks, private clubs, school grounds, and college campuses have facilities where large numbers of people enjoy participation sports. The city is famed for its park system, dating from the establishment by the city council in 1839 of Dearborn Park on the present site of the central public library. In 1934 an important step toward efficiency and economy was taken by the creation of the Chicago Park District consolidating the 22 park districts then existing. The five commissioners of the park district, appointed by the mayor, have control over the principal parks; other parks and recreational areas remain within the jurisdiction of the department of public works and the board of education.

Along the lake front lie three great parks, Lincoln, Grant, and Jackson, connected by the belt of outer drives. Lincoln (1,119 acres) lies on the North Side; among its facilities and attractions are a golf course, bathing beaches, play fields, bridle paths, a conservatory, and the zoo. Statues and memorials honor, among others, Sieur de la Salle, Hans Christian Andersen, Eugene Field, Benjamin Franklin, Friedrich von Schiller, Johann Wolfgang von Goethe, Giuseppe Gar-

baldi, and John Peter Altgeld, governor of Illinois (1892-1896). Its Lincoln statue, like another in Grant Park, is by Augustus Saint-Gaudens. Grant Park (303 acres) is the city's "front yard." It is situated on the lake front from Randolph Street to 14th Street. Its principal features are a band shell and Buckingham Memorial Fountain. The fountain stands in a beautifully landscaped plaza; into its 280-foot pool falls the spray from its jets and central geyser. During summer months colored lights play on the fountain at night. Summer evenings bring concerts at the band shell, at which distinguished conductors and soloists appear with a symphony orchestra. Jackson Park (543 acres) on the South Side stands on the site of the Columbian Exposition of 1893. Besides its play fields, beaches, bridle paths, and similar attractions, the park has a lagoon where rowboating is enjoyed, and a bird sanctuary. Much of the land on which these three parks are built, as well as the area traversed by the outer drives, is "made" land reclaimed from the lake by dredging and filling.

About one mile west of Jackson Park is Washington Park at the west end of the Midway Plaisance, which cuts through the campus of the University of Chicago. The university's noble Gothic buildings add beauty to the Plaisance, the scene of college intramural games during the spring and autumn and the location of ice-skating rinks in the wintertime. Washington Park (371 acres) has a boating lagoon, a field house, and other facilities. In all, the city has 243 other parks and recreational areas, many of them equipped with field houses, natatoriums, and other permanent fixtures.

The Cook County Forest Preserves give Chicagoans means of enjoying the pleasures of wild and semiwild country on a scale unavailable to the residents of any other American metropolis. While this belt of over 37,500 acres on the city's outskirts contains facilities for such sports as golf, swimming, and tobogganing, its unique value lies in the opportunity it affords the urban dweller of escaping from the congestion, turmoil, and tension of the city to beautiful and relaxing natural surroundings. Amateur photographers, hikers, bird-watchers, naturalists, and picnickers find in these forest lands boundless resources for the promotion of their avocations. Here, also, is the home of the Chicago Zoological Park (popularly called the Brookfield Zoo) where animals are kept as nearly as possible in re-creations of their natural habitats.

Churches, Charities, and Institutions.—

With its more than 2,000 churches of all denominations, Chicago has few that antedate the Great Fire of 1871. Among many churches noted for their architecture or beauty of ornamentation are the Chicago Temple (Methodist-Episcopal) in the Loop, Holy Name Cathedral, the Fourth Presbyterian Church, Temple Shalom, Rockefeller Memorial Chapel, and the diminutive but gem-like Thorndike Hilton Memorial Chapel of the Chicago Theological Seminary. Hull House (1889), Northwestern University Settlement (1891), the University of Chicago Settlement (1894), and the Chicago Commons Social Settlement (1894) are outstanding in work among the underprivileged. Municipally maintained institutions include the laboratories, clinics, and other services of the board of health; the Municipal Tuberculosis Hospital and the Convalescent

Home. State, county, and federal government, as well as several universities and other agencies, support and conduct the activities of the Medical Center on the West Side. The center is an expanding aggregation of hospitals, clinics, laboratories, schools, and other facilities. The department of welfare, besides providing institutional care for thousands of applicants, carries on an extensive rehabilitation program and dispenses relief and assistance in a number of forms.

Government.—The problem of governing Chicago's millions is complicated by the fact that no governmental unit corresponds to the metropolitan area which socioeconomic conditions have created. The boundaries of Chicago and Cook County are not coterminous; the sanitary district includes a large area outside the city's limits; and in addition to these three major units, there are a number of lesser ones, some of them with their own taxing and bonding powers being virtually autonomous.

The executive head of the city is the mayor, elected for a term of four years. He presides over the unicameral council, the legislative body composed of one alderman from each of the city's wards (further subdivided into precincts). The mayor has extensive appointive power, naming the members of the board of education, the park district, the public library board, the municipal sanitarium board, and a number of special commissions. Finances are administered by the department of finance headed by the comptroller. Revenues of the general corporate purposes fund are derived about equally from the tax levy and from miscellaneous sources, of which the most important are licenses, franchise compensations, and the amusement tax. Besides the corporate purposes fund, there are auxiliary funds (for example, water funds, bond funds, retirement funds) into which revenues are received and from which disbursements are made. Disbursements from the corporate purposes fund were nearly \$77,000,000 in 1948; and from all funds, over \$280,000,000.

The police and fire departments and the bureaux of streets and electricity account for nearly two thirds of all expenditures from the corporate purposes fund. The police department is headed by a commissioner, under whom serve 40 district captains, the heads of the detective and traffic bureaux, and officials of other divisions. The department's activities lead to the prosecution of hundreds of thousands of cases and the recovery of millions of dollars worth of lost and stolen property each year. The fire department, also headed by a commissioner, maintains land- and water-borne fire-fighting apparatus, ambulances, and other emergency equipment. The bureau of streets has charge of the public ways—streets, sidewalks, and alleys. Besides paving, cleaning, and maintaining the city's 3,800 miles of streets, the bureau supervises sidewalk paving (done under private contract), collects refuse, removes snow, destroys weeds, and cares for traffic markers and street signs. The bureau of electricity has charge of street lighting, safety island and curb lighting, the traffic signal system, and the police and fire alarm systems. The police and fire signal network alone, with its 26,000 miles of wires and cables, is the equivalent of the communications system of a fair-sized community.

There is a multiplicity of other departments and bureaux, each responsible for a sector of the public service. Most employees are under civil service, administered by a civil service commis-

sion. The municipal courts are headed by an elected chief justice and associate judges. Also having jurisdiction in the city are the county courts, state superior and circuit courts, and federal district and appellate courts. However, a large majority of all cases arising in the city are handled by the municipal court system, which has numerous special branches such as a court of domestic relations, a boys' court, and a women's court.

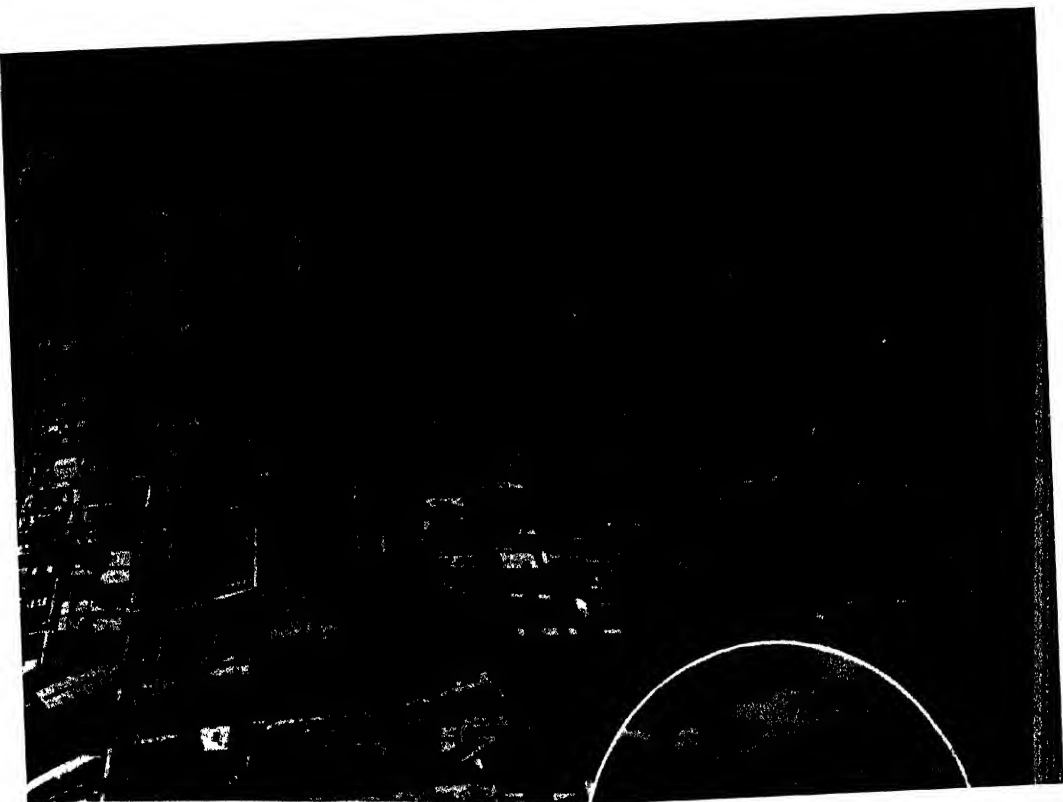
A city is analogous to a biological organism in that it will perish by starvation of its supply of water is cut off, or by self-contamination if its waste products are not removed. Hence for the city the problems of water supply and of waste disposal are intimately connected. Chicago, unlike many other cities, has no problem so far as a water source is concerned, for Lake Michigan is an inexhaustible reservoir at the city's front door. But the problems associated with the transport of water and with the prevention of contamination have taxed engineering skill to the utmost. Chicago's water is drawn from the lake through inlets (cribs) located two to three miles offshore. It is gravity-fed through tunnels to pumping stations, and then forced into the mains. Chlorination at the pumping stations is the principal means of purification. This basic system was modified, and greatly improved, for the South Side with the placing in operation (May 1947) of the south district filtration plant. Water used in the south district (about one third of the city's total) is completely treated by settling, coagulation, filtration, and the use of activated carbon. Chicago's water system (under the direction of the bureau of public works) bears an ever-increasing burden. In addition to meeting the demands of its own growing populace, the city supplies more and more outlying districts whose plants have become overburdened or whose sources of ground water are failing. In 1947, about 7 per cent of the average daily pumpage of 980,000,000 gallons went to these suburban areas. Contamination is the great danger to Chicago's supply, for Lake Michigan's waters are safe in their natural state. The outflow of wastes from the city, originally dumped into the lake, so imperiled this supply that drastic steps had to be taken. In 1889, the sanitary district of Chicago was established. The district comprises 407 square miles and serves about four million people. Under its direction the Sanitary and Ship Canal, connecting the Chicago River to the Des Plaines (thus reversing the flow of the former), and the Sag Channel, connecting the canal and Lake Calumet, were built to provide a gigantic sewer flushed by the waters of Lake Michigan. This process of "dilution" became inadequate as the city grew, and was replaced by a system of treatment which effectively removes waste from the collected sewage water. Waste water is initially collected by local sewers operated by the city, and then dumped into the interceptor sewers of the sanitary district. From the interceptors the water is drained into settling tanks where solid wastes are removed. The remaining wastes, which have not yielded to the settling process, are removed by activated sludge. The waste water, then virtually free of objectionable materials, is finally discharged into the canal. The treatment works have a capacity of over a billion gallons per day. The sanitary district is governed by an elected board of trustees.

History.—Like Rome, Chicago "was not built

in a day," but the extraordinary rapidity of its early growth was a source of wonderment. Though the town was not incorporated until 1833, by the end of the 19th century a foreign observer declared Chicago to be "the greatest expression of American genius." The French explorers, Jacques Marquette and Louis Joliet (qq.v.), are known to have visited the site of Chicago in 1673. During the era of exploration, the easy portage at this point made it much frequented by adventurers, missionaries, and agents of the French government. Thus the white man came to know the locality which long before had been recognized by the Indian as a natural crossroad. The French claim was transferred by the Treaty of Paris (1763) to British hands, but neither France nor Britain developed in any extensive way the commercial and military potentialities of the region. After the American Revolution, both Virginia and Connecticut laid claim to the section; but all claims were finally renounced in favor of the federal government (1784–1786). As a part of the Northwest Territory created by the Ordinance of 1787, the Chicago region was organized as Knox County in 1790. Successive county reorganizations followed, ultimately terminating in the formation of Cook County, as a subdivision of the state of Illinois, in 1831. Two years later, Chicago was incorporated as a town; and, in 1837, as a city (population 4,000).

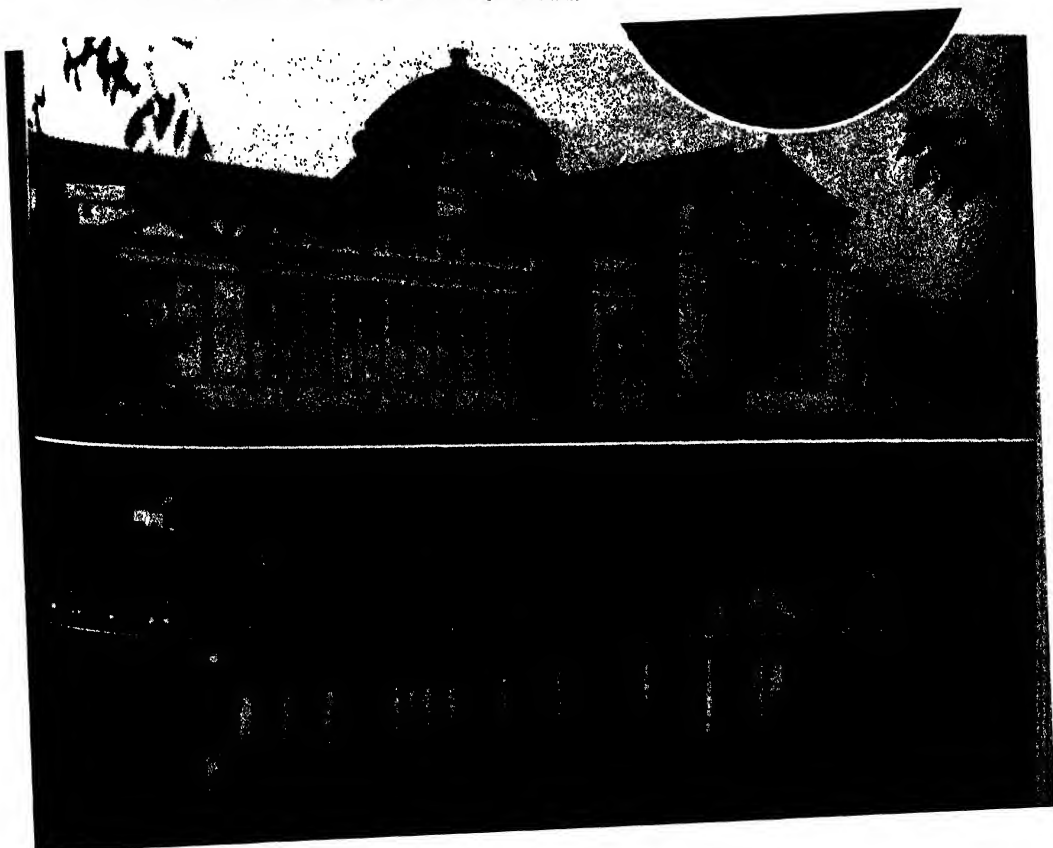
Early life in the settlement was that of the typical frontier trading center and military outpost. In 1803–1804, a stockaded fort, Fort Dearborn, was built on the south bank of the Chicago River where Michigan Avenue now passes, as a link in the defense of the northwest frontier and a stabilizing influence among the Indians. The garrison at Fort Dearborn was not large, and with mounting unfriendliness among the Indians during the War of 1812 the decision was reached to abandon the post. On the morning of their departure (Aug. 15, 1812), the evacuees were attacked from an ambush near the fort; and 51 of the company, including several women and children, were slain. Of the survivors, all of whom were taken captive, a number later perished at the Indians' hands. A second Fort Dearborn was built in 1816–1817. Trade with the Indians during the first two decades of the 19th century was principally carried on by a government factor attached to the fort, but demands of private traders forced the closing of the government's trading operations in 1822. The days of the Indian in Chicago soon drew to a close, however; in September 1833, provisions were made for removal of all Indians from the vicinity, and three years later (1836), Fort Dearborn was abandoned.

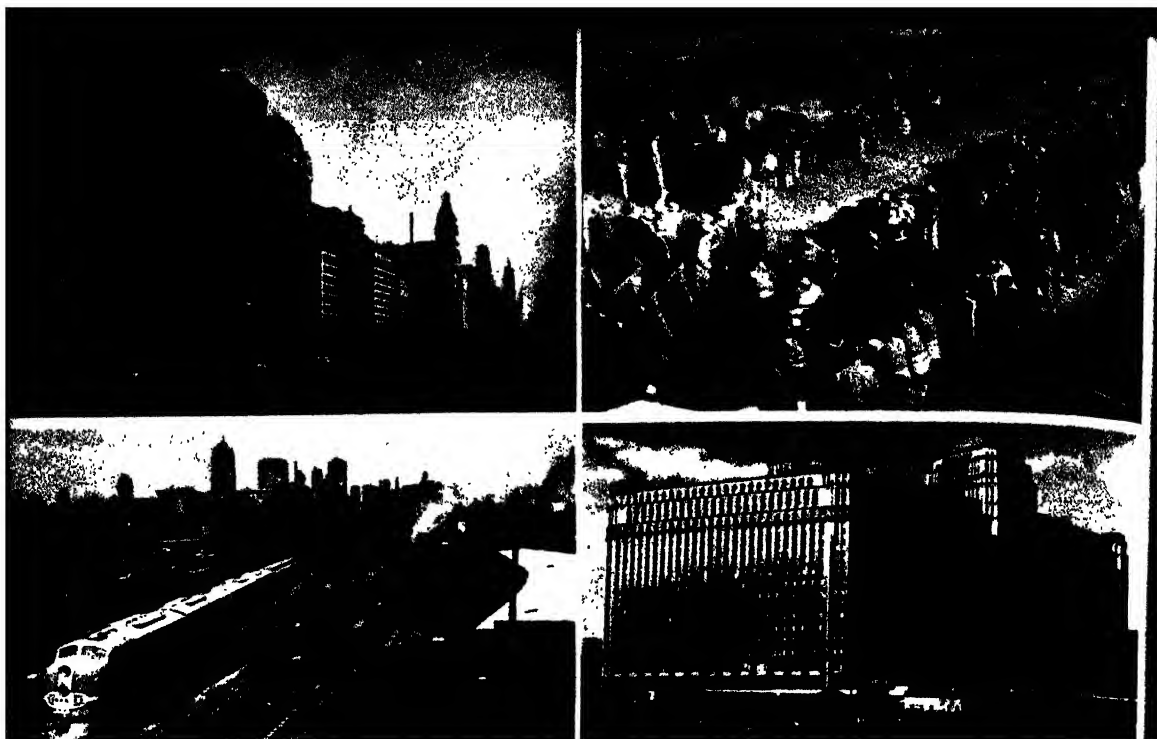
In the early period the development of water transportation was a factor of prime importance in the town's development. The opening of the Erie Canal in 1825 provided a highway for immigration to the West; and the removal of the sand bars, which so blocked the mouth of the Chicago River as to make it unusable as a harbor, began in 1834. As new settlers took up their homes in the town and trade and commerce flourished, Chicago experienced a flurry of the land speculation mania so common to frontier areas. During the early 1830's, land values skyrocketed, and Chicagoans found themselves in the floodtide of a prosperity as specious as it was exhilarating. Unsupported by much in the way of material achievement, the boom was short-lived.



CHICAGO Top: Aerial view of downtown Chicago, where the Chicago River runs under the city's many bridges from Lake Michigan. Inset: Steamer entering the Chicago River with a Shore Drive bridge lifted. Center: The Museum of Science and Industry, Jackson Park, Chicago. Bottom: Night scene of Chicago's lights along Michigan Avenue.

Photographs by: (top) United Air Lines; (insert) Ewing Galloway, New York; (center) Territorial Information Department, Chicago; (bottom) Chicago Park District

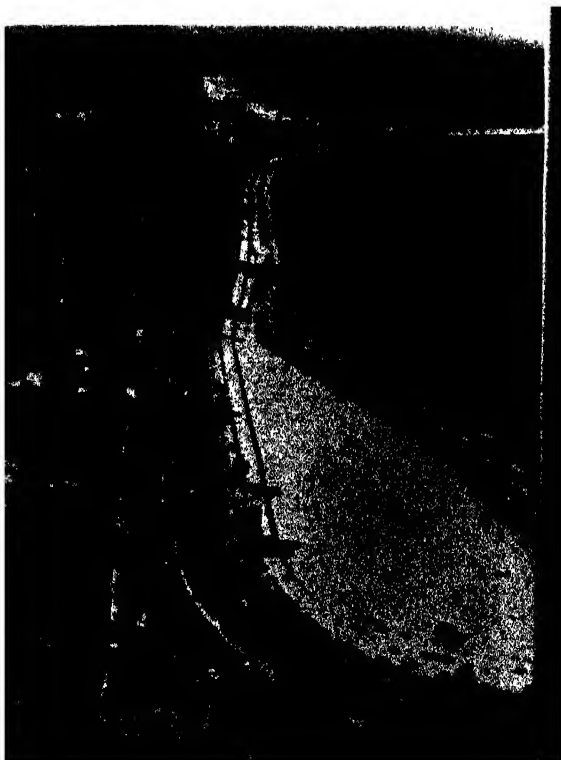




CHICAGO

Top left: Michigan Avenue skyline, part of Chicago's "Magnificent Mile," and Grant Park, facing Lake Michigan. *Top right:* Young farmers exhibiting their Angus cattle in a stock show, one of many held year round in Chicago, the meat packing center of the United States. *Center left:* The Dearborn Station, one of six major terminals in Chicago, with a modern Diesel streamliner ready to depart. *Center right:* The Merchandise Mart on the Chicago River; one of the largest commercial buildings in the world, employing about 26,000 persons, it is two city blocks long and one block wide. *Bottom left:* The Michigan Avenue Bridge with the Wrigley Building on the left, and the Tribune Tower on the right. *Bottom right:* An aerial view of the Oak Street Beach on Lake Shore Drive, and part of "The Gold Coast," Chicago's wealthy residential section.

Photographs by: (top left) Ewing Galloway, New York; (top right) Territorial Information Department, Chicago; (bottom right) Philip Gendreau, New York; (all others) Chicago Association of Commerce and Industry



and the whole economic structure collapsed in the general panic of 1837. The town now lapsed into a decade of stagnation, and many of her citizenry despaired of the future. Ultimate recovery and further progress had to wait on more substantial accomplishments.

Construction of the Illinois and Michigan Canal, linking Lake Michigan and the Mississippi River system, commenced in 1836, was completed 12 years later (1848). That same year, the opening of the first railroad line into the city, the Galena and Chicago Union, marked a new era in which land transportation would set the pace. While river, canal, and lake continued to be of immense value as carriers, more and more it was the expanding rail network that wrought the transformation of Chicago from frontier post to modern city. Chicago's development as the commercial outlet for a rich hinterland brought recovery from the disastrous panic which paralyzed the city in the years following 1837. By mid-century, wheat, meat, and lumber had laid a solid foundation for Chicago's economic growth.

Though hit hard by the panic of 1857, Chicago renewed her advance in Civil War years when the city supplied large amounts of war matériel; and business expansion continued after peace returned. The Union Stockyards opened in December 1865, providing facilities for the livestock industry far superior to those which had hitherto been afforded by the smaller, scattered yards. The packing industry, too, underwent a process of rapid consolidation that resulted in the disappearance of many small firms and the appearance of such great establishments as Armour and Company, and Libby, McNeill and Libby. Long-distance shipment of refrigerated meat began in the late 1860's, and the processing of meat byproducts was developed into an important adjunct of the packing industry. While Chicago had turned to the manufacture of iron products in the 1850's, it was not until after the Civil War that pig iron was made in the city. By the 1870's the foundations were laid for the gigantic iron and steel industry that was to come. Rail connections with the Mississippi River had been established in 1854; the completion of the Union Pacific Railroad in 1869 gave the city access to the Pacific coast. By 1870, through travel from Chicago to New York was a possibility; and in 1873, the last link was forged in a trunkline from the city to New Orleans and the Gulf of Mexico. The founding of the Pullman Palace Car Company in 1867 gave the city one of its distinctive industries closely associated with the railroad boom. Merchandising flourished, as did manufacturing and transportation. Great retailing firms of the city grew to take their places among the nation's leaders. As supplements to the already firmly-established trade with the Middle West, trade with the South was rapidly resumed after the Civil War ended, and soon salesmen and agents spread the city's wares to the developing Southwest.

The disaster of 1871, the Great Fire, actually opened the way for new advancement by destroying a large part of the city. The wooden buildings swept away by the flames were replaced by more substantial structures of brick and stone. The fire broke out Oct. 8, 1871, in a barn on De Koven Street. The barn belonged to Patrick O'Leary, and familiar legend has it that Mrs. O'Leary's cow kicked over a lantern, igniting the straw strewn about. There had been a

drought, so everything was dry. The flames quickly got out of the firefighters' control, and the fire swept toward the northeastern section of the city. On Oct. 9, the North Side burned; with destruction of the waterworks, the struggle to save the city became hopeless. Homes, hotels, stores, factories, business buildings, schools, churches, railroad stations, bridges, all were wiped out. Property loss was estimated as follows: buildings and improvements, \$50,000,000; produce, lumber, and provisions, \$5,000,000; dry goods and manufactures, \$75,000,000; household property, libraries, etc., \$57,000,000—a total of \$187,000,000. Loss to the city in public buildings and property was placed at \$2,500,000.

Recovery from this disaster was unbelievably rapid. Alternating periods of prosperity and depression marked the economic life of Chicago in the late 19th century, as they did that of the country at large. But despite bitter depressions in 1873-1879, 1883-1886, and 1893-1897, the city forged ahead. A spirited rivalry between Chicago and St. Louis for leadership among the cities of the Mississippi Valley was finally resolved in favor of the former during the 1870's. The census of 1870 revealed the two cities as neck and neck in the race; but by 1880, Chicago (with 503,185 inhabitants), had left St. Louis (with 350,518) far behind. The decades after the Civil War saw an economy based on trade and the agricultural and extractive industries change to an economy in which manufacturing and finance played an ever-increasing part. Just as the town had grown to city in earlier days, so the city expanded to metropolis. Chicago owes her metropolitan status in no small degree to the far-sighted, boldly aggressive, and sometimes ruthless business leaders whose careers were inextricably interwoven with the city's history. Cyrus H. McCormick (agricultural implements), William B. Ogden (railroads), Potter Palmer (real estate, merchandising, hotel business), Philip D. Armour and Gustavus F. Swift (meat packing), Marshall Field (merchandising)—to mention these names (and a score and more of others) is to evoke a picture of the dynamic energy that characterizes the city. It was Chicago's good fortune that in an age of the most intense individualism there were many men of this kind who, for all their personal ambition, retained a civic consciousness and contributed to the common good through their wisdom and their generous benefactions.

By 1880, Chicago had a labor force of over 450,000 workers. Faced with the problem of making their way in a changing economy, and restive under the hardships that were their lot, workmen sought to better their condition by organization. The city became one of the focal points of the developing labor movement. Such periodic outbreaks of labor violence as the rioting connected with the great railroad strikes of 1877, the Haymarket Square Riot (q.v.) of 1886, and the Pullman-rail strike of 1894 have been highly publicized because of their dramatic qualities. More fundamental, but less spectacular, contributions of the city's leaders and workers have sometimes been overlooked. The Illinois State Federation of Labor (1884) and the Chicago Federation of Labor (1895) became models of state and city organization, copied throughout the country. Their influence did much to secure liberal and equitable legislation by which workmen have benefited. A number of present day

international unions are outgrowths of early Chicago local organizations. Chicago has become a strongly unionized city. Development of great labor organizations, like the rise of great business enterprises, was one of the evidences of Chicago's maturation.

As has been true in most other states, jealousies and misunderstandings between the rural areas and the expanding city reflected a disparity in modes of life and habits of thought. Often the result was inhibiting legislation that kept Chicago's political institutions from evolving to meet new problems. Nevertheless, progress was made, even though long delayed. Creation of the sanitary district in 1889, and piecemeal passage of amending legislation that liberalized the Chicago charter of 1875 were steps in the right direction. In 1906, a municipal court system was established, and in 1907 the mayoral term was lengthened from two to four years. In 1921, the city's wards were reorganized and increased in number from 35 to 50; at the same time, representation in the common council was changed so that each ward had one instead of two aldermen, resulting in a more compact and manageable legislative body. In 1934, aldermanic terms were extended from two years to four. In the same year, creation of the consolidated park district abolished one of the city's worst jurisdictional tangles, which had developed during the years by the erection of numerous autonomous park districts. Frequent annexations of adjacent territory have extended the city limits. The largest single annexation was that voted on June 29, 1889. It added 125 square miles of territory, and more than quadrupled the city's area.

Chicago's development has been guided in later years by the Chicago Plan Commission, instituted in 1909 as a permanent advisory body whose members are appointed by the mayor. Daniel H. Burnham, Chicago architect and chief of construction for the Columbian Exposition of 1893, aroused the community to a realization of the city's shortcomings and inspired it to enthusiasm for projects of improvement. Burnham's comprehensive plan recognized the various phases of the problem, utilitarian, aesthetic, and cultural: improved facilities of transportation, expanded recreational facilities, and improvement of the park system and the lake front. Some of Burnham's specific suggestions have been carried out, some modified, and some rejected; but the whole schedule of civic advancement in Chicago since 1909 has been influenced by his study of the needs and the possibilities.

The 1920's was a period of turbulence in Chicago's history, the period of the bootlegger, the racketeer, and the gangster. While marred by violence, corruption, and abuse of public trust, the decade saw solid accomplishments, too. In these years Buckingham Fountain, the Planetarium, and the Museum of Science and Industry were built, adding new beauty to the lake front, along which additional drives were constructed. The tempo of economic life quickened, products of the city's factories mounting to over 3 billion dollars by 1929. Then came the depression period of the 1930's, during the emergence from which Chicago, the United States, and all the rest of the world became involved in World War II. As in previous wars, Chicagoans contributed loyally to the nation's efforts. Men, money, and material were forthcoming in vast amounts. It was also in wartime Chicago that man pro-

duced the first atomic chain reaction, an achievement that led to the climactic termination of the conflict and may well have set the stage for a revolutionary transfiguration of the world that the future alone can reveal.

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DAVID M. BEHEN,
Sometime Lecturer and Assistant in History,
The University of Chicago.

CHICAGO, BURLINGTON & QUINCY RAILROAD, popularly known as the Burlington Route, a system operating extensively in the upper Mississippi and Missouri River valleys and between the Great Lakes and the Rocky Mountains. The original corporate unit of the system was the Aurora Branch Railroad Company, chartered in Illinois Feb. 12, 1849; changed to Chicago and Aurora Railroad Company June 22, 1852, and to the present corporate title of Chicago, Burlington & Quincy Railroad Company on Feb. 14, 1855. The first track built was from Aurora to West Chicago. Burlington rails reached the Mississippi River opposite Burlington, Iowa, in 1855; the Missouri River near Omaha, in 1869; Denver, in 1882; St. Paul, in 1886; and Billings, Mont., in 1894. In connection with the Hannibal & St. Joseph Railroad, which it subsequently acquired, the Burlington established the first rail service between Chicago and the Missouri River in 1859.

The length of road operated on Dec. 31, 1949 was 8,873 miles, of which 8,297 were owned and 576 were leased or operated. The mileage owned, by states, was as follows: Nebr., 2,675; Ill., 1,615; Iowa, 1,016; Mo., 1,157; Wyo., 678; Colo., 392; Kans., 217; So. Dak., 168; Wis., 220; Mont., 135; Minn., 23. Including second, third, and fourth tracks, and yards and sidings, the total mileage owned was 12,549.

The principal routes of the Burlington are between Chicago and Denver via Omaha; Chicago and St. Paul-Minneapolis via the Mississippi River; Chicago and Kansas City and St. Joseph via Quincy; St. Louis and Minneapolis; St. Louis and Denver via Kansas City and St. Joseph; Kansas City and Omaha; Lincoln and Billings; Chicago and St. Louis and Paducah; and Denver and Billings. Over 97 per cent of the capital stock of the Burlington is owned in equal parts by the Great Northern and the Northern Pacific railways, with which it connects at St. Paul and Billings to form a through route to the Pacific Northwest. The Burlington, in turn, controls the Colorado and Southern Railway which provides a rail route from Wyoming to the Gulf of Mexico.

Early in 1950, equipment consisted of 967 locomotives, 43,819 freight cars, and 1,073 passenger cars including 13 streamlined diesel Zephyr trains. A Burlington Zephyr, completed April 9, 1934, was America's first diesel-powered, streamlined train. On May 26, 1934, it set a world's record

by traveling non-stop from Denver to Chicago in 13 hours 5 minutes—1,015 miles at an average speed of 77.6 miles an hour. America's first Vista Dome car, a stainless steel coach embodying an elevated, glass-enclosed dome, was put in service between Chicago and the Twin Cities, St. Paul and Minneapolis, on July 23, 1945. In 1950, 23 Vista Dome cars were in operation on the scenic routes between Chicago and the Twin Cities, and Chicago and San Francisco.

On Dec. 31, 1949, the capital stock of the company totaled \$170,839,100; its funded debt, \$182,337,061; and its total assets \$688,688,966. The road and equipment were valued at \$757,887,340; accrued depreciation and amortization, \$173,025,359; net, \$564,861,981. Operating revenue during the year ended Dec. 31, 1949, totaled \$217,996,508; operating expenses, \$167,265,649; net railway operating revenue \$50,730,859, and net railway operating income, \$19,620,338.

H. C. MURPHY, *President*.

CHICAGO, INDIANAPOLIS AND LOUISVILLE RAILWAY (familiarily known as the MONON) traces its corporate ancestry back to the New Albany & Salem Railroad Company which was chartered by the State of Indiana on July 31, 1847. At that time, New Albany with a population of 7,000 people was the largest community in the state and, like its more populous neighboring Kentucky city of Louisville, owed its location and growth to the falls of the Ohio River which provided a natural site for trade and commerce.

The New Albany & Salem Railroad was completed over the 35 miles of distance between those Indiana points named in its title in January 1851; but Indiana's one harbor on Lake Michigan, Michigan City, was the real goal. Service between these two termini, 288 miles apart, was begun on July 4, 1854. All of the line had been constructed by the New Albany & Salem Railroad, except the 27-mile segment between Crawfordsville and Lafayette, which had been completed in June 1852 to connect the former community with the Wabash and Erie Canal and acquired within the same month by the New Albany & Salem Railroad.

The charter of the New Albany & Salem Railroad permitted it to build anywhere within the State of Indiana, and this franchise was used to permit the construction of the Michigan Central Railroad across the northwestern edge of the state and so win its race in May 1852, by a single day, as the first eastern railroad to enter Chicago.

The New Albany & Salem Railroad failed in the panic of 1857, and was reorganized after foreclosure in the following year as the Louisville, New Albany & Chicago Railroad. This road played an important role in the Civil War, and the funeral train carrying the body of the martyred President Lincoln passed over its line between Lafayette and Michigan City en route to Chicago.

Changes in the corporate relationships of railroads that had previously provided the Louisville, New Albany & Chicago with access over friendly connections to the traffic of Chicago, Indianapolis, and Cincinnati led to traffic losses which occasioned a second receivership between 1868 and 1872. Between 1879 and 1882, the Louisville, New Albany & Chicago endeavored to correct this handicap by providing its own direct route between Chicago and Indianapolis which crossed

the Michigan City-New Albany line at the station later given the name of Monon that identifies the road itself. (Monon is an Indian word meaning swift running.) The branch into the popular resort with its sulfur springs at French Lick was built in 1886-1887.

A third reorganization followed the panic of 1893. A receiver was appointed in August 1896 and the company passed, after foreclosure, to the Chicago, Indianapolis and Louisville Railway Company on March 31, 1897. In July 1902, the Louisville & Nashville and the Southern Railway acquired 87 per cent of the stock of the Monon. The latter company prospered until the depression of the 1930's brought it into bankruptcy on Dec. 30, 1933. Its fourth reorganization was consummated on May 1, 1946.

JOHN W. BARRIGER,
President.

CHICAGO, MILWAUKEE, ST. PAUL AND PACIFIC RAILROAD COMPANY, incorporated March 31, 1927, was organized under the laws of Wisconsin in order to take over the properties of Chicago, Milwaukee and St. Paul Railway Company, a Wisconsin corporation (organized May 5, 1863, as the Milwaukee and Saint Paul Railway Company, "Chicago" having been added to its name Feb. 11, 1874), after receivership and mortgage foreclosure proceedings, culminating in sale of its property on Nov. 22, 1926; and reorganized after bankruptcy by amendment of charter but without change of name, effective as of Dec. 1, 1945. On June 29, 1935, the company had filed a petition for reorganization under Section 77 of the National Bankruptcy Act in the District Court of the United States for the Northern District of Illinois, Eastern Division; and on that date the court issued its order approving the petition as properly filed. Thereafter, in pursuance of a plan of reorganization certified by the Interstate Commerce Commission by order dated April 10, 1944, Finance Docket 10882, and confirmed by the district court by order dated Feb. 23, 1945, the company was reorganized by amendment of charter, the amendments being approved by order of the same court dated Nov. 26, 1945. In accordance, the property was vested in the reorganized company as of Dec. 1, 1945. The total capitalization was reduced from \$708,100,000 to \$558,100,000. Fixed interest bearing debt was reduced from \$300,800,000 to \$97,200,000. Contingent interest bearing debt was reduced from \$182,900,000 to \$116,400,000.

From its early days, the company's history records steady growth through the acquisition of smaller lines until a system developed, extending from Chicago and Milwaukee to Saint Paul, Kansas City, Mo., Omaha, and many other points in Wisconsin, Iowa, Minnesota, North Dakota, and South Dakota. As of Jan. 1, 1913, Chicago, Milwaukee and St. Paul Railway Company acquired the property of its subsidiary, Chicago, Milwaukee and Puget Sound Railway Company, which operated 2,081 miles of main and branch lines, extending from Mobridge, S. Dak., to Seattle and Tacoma, Wash. Subsequently, other lines were acquired, including the Idaho and Washington Northern Railroad, Big Blackfoot Railway Company, Tacoma Eastern Railroad Company, Puget Sound and Willapa Harbor Railway Company; Seattle, Port Angeles and Western Railway Company; Bellingham and Northern Railway Company, Milwaukee Terminal Railway Com-

pany, Gallatin Valley Railroad Company, and Chicago, Milwaukee and Gary Railway Company. The properties of the Chicago, Terre Haute and Southeastern Railway Company which had been operated by the Milwaukee company or its predecessors since July 1, 1921 under a 999-year lease, were conveyed to the Milwaukee company by deed dated Dec. 31, 1948. The lease was cancelled. The Milwaukee company deposited an amount equal to \$10 per share for each share of Terre Haute capital stock not owned by the Milwaukee, and under an agreement of Dec. 31, 1948, between the two companies the Milwaukee assumed obligation and liability in respect of the payment of principal and interest on the outstanding Terre Haute bonds.

Location and Mileage.—On Dec. 31, 1949, Chicago, Milwaukee, St. Paul and Pacific Railroad Company operated 10,671 miles of railroad, of which 9,842 were solely owned, 165 jointly owned, and 664 were operated under trackage rights. It operated within 14 states: Idaho, Illinois, Indiana, Iowa, Kansas, Michigan, Minnesota, Missouri, Montana, Nebraska, North Dakota, South Dakota, Washington, and Wisconsin. Between Harlowton, Mont., and Avery, Idaho; and between Othello and Tacoma, Wash., 662 miles had been electrified.

Equipment.—On Dec. 31, 1949, the company owned 910 steam, 49 electric and 185 diesel-electric locomotives; 59,522 freight cars; 1,086 passenger cars, 17 rail motor cars, 1 tugboat, 4 car barges, and 3,223 units of company service equipment. Diesel-electric locomotives were performing 37 per cent of freight operation; 50 per cent of passenger operation; and 50 per cent of yard switching. Further dieselization was planned.

Traffic and Characteristics of Territory.—Serving as it does the Northwestern states, agricultural production (including animals) is normally important to the road, accounting in 1949 for approximately 26 per cent of freight revenue. Wheat from the spring wheat regions of Minnesota, South Dakota, and Montana, is carried eastward to Minneapolis and St. Paul where it is made into flour and distributed. Corn, oats, barley, and rye, cattle from the Northwestern region, and hogs and meat products from the corn belt are important traffic items. While agricultural products are exceeded by the manufactures and miscellaneous classification, which produced 41 per cent of freight revenue in 1949, the most important single revenue-producing commodity was bituminous coal. There is a large production of bituminous coal originating, for the most part, in Indiana, which is distributed at points along the railroad or delivered to connecting railroads. This coal competes with other bituminous coal originating in Southern Illinois, Kentucky, and West Virginia and other eastern origins. Lumber, refined petroleum products, gasoline, manufactured iron and steel, including pipe and fittings, agricultural implements, cement, wood pulp, canned food products, liquors, and malt comprise other major commodities carried.

The number of passengers carried in 1949 was 8,102,277, the total of passenger-miles was 874,444,524, and the average rate per passenger-mile was 2.22 cents. The company's better-known trains are the *Olympian Hiawatha* and the *Columbian*, operating between Chicago and Seattle and Tacoma, Wash.; morning and afternoon *Twin Cities Hiawathas* operating between Chicago, Mil-

waukee, St. Paul, and Minneapolis; the *Midwest Hiawatha* operating between Chicago, Ill., and Des Moines, Iowa; Omaha, Nebr.; Sioux City, Iowa; and Sioux Falls, S. Dak.; and the *Pioneer Limited* which is a long-established overnight train between Chicago and Minneapolis and St. Paul.

Financial.—On Dec. 31, 1949, the balance sheet showed the following: investment in transportation property less depreciation, \$525,900,000; total investments, \$568,400,000; current assets \$89,000,000; total assets, \$662,900,000; capital stock, \$324,500,000; long-term debt, \$228,900,000; current liabilities, \$44,800,000; net working capital, \$44,200,000; earned surplus, \$59,400,000; and total liabilities, \$662,900,000.

Revenues and Expenses.—Operating revenues for the year 1949 were \$238,000,000; operating expenses were \$202,100,000; net railway operating income was \$10,900,000; and net income was \$4,500,000. The average number of employees in 1949 was 35,131. Wages and payroll taxes were \$140,500,000, equal to \$4,000 per employee, and were equivalent to 59 per cent of the operating revenues.

The year 1950 marked the opening of the railroad's second century of service. Operation of the original predecessor company began on Nov. 20, 1850, with the running of a train a distance of five miles from Milwaukee to Wauwatosa, Wis.

C. H. BUFORD, *President*.

CHICAGO, ROCK ISLAND AND PACIFIC RAILROAD COMPANY. This company (CRI & PRR Co.) was incorporated December 16, 1947 under the laws of Delaware, term of corporate existence not limited. The company is successor under a plan of reorganization, confirmed May 23, 1947, to The Chicago, Rock Island and Pacific Railway Company. To the new company was transferred all properties of the earlier one, together with its subsidiary companies. The transfer was effective January 1, 1948, and on that date the new company commenced operations.

The company operated approximately 7,620 miles of road in 1950 (known as the Rock Island Lines), of which about 7,157 miles were owned and 463 miles were trackage rights. In addition, it operated 651 miles of second and other main tracks. It operated in 14 states, its general system radiating from Chicago through Illinois, Iowa, Nebraska, Kansas, and Colorado to Denver and Colorado Springs; north through Minnesota to St. Paul and Minneapolis; southwest via Kansas City, Mo., through Oklahoma and New Mexico to Santa Rosa, N. Mex.; south through Texas to Fort Worth, Dallas, Houston and Galveston; and from Memphis, Tenn., westward through Arkansas and Oklahoma to Tucumcari, N. Mex. Rounded off to the nearest final digit, the mileage of these principal main lines was as follows: Chicago, via Kansas City, to Santa Rosa, 1,168; Davenport, Iowa, via Des Moines to Colorado Springs and Denver, 979; Herington, Kans., to Fort Worth, Dallas, Houston, and Galveston, 775; Burlington, Iowa, via Cedar Rapids, to Minneapolis, 366; Memphis, Tenn., via Little Rock and Oklahoma City to Tucumcari, 874; St. Louis, Mo., to Kansas City, Mo., 295. Principal secondary main or branch lines were: Vinton, Iowa, to Sioux Falls and Watertown, S. Dak., 420; McFarland, Kans., to Belleville, Kans., 103; Little Rock, Ark., to Eunice, La., 309.

During an intensive improvement period, Jan. 1, 1938 to Nov. 30, 1949, a total of 385,841 tons of new rail was laid, the equivalent of some 2,160 track miles. As part of the same improvement program, as of Dec. 31, 1949, 2,505 miles of the system had been equipped with automatic block signals and an additional 830 miles with centralized traffic control.

The principal affiliate companies are Peoria Terminal Company, which is a terminal company operating at Peoria, Ill.; Peoria and Bureau Valley Railroad Company, which owns a line of railroad about 46 miles long between Bureau and Peoria, Ill.; Burlington-Rock Island Railroad Company (50 per cent owned by the CRI & PRR Co.) which owns almost 212 miles of railroad in Texas over which the CRI & PRR Co. operates between Dallas, Houston, and Galveston; and The Rock Island Motor Transit Company, a wholly-owned trucking subsidiary, which operates 5,134 route miles in 11 Midwest states, with 620 pieces of equipment. At Santa Rosa, N. Mex., the company ties in with the Southern Pacific Railroad and, jointly with that company, operates through service to Arizona and California points.

Passengers carried in 1949 were 12,000,000. The total of freight traffic handled was 38,500,000 tons of which the products of mines and forests constituted 15 million tons; manufactures, 12 million tons; agricultural products, 10 million tons; and livestock and their products, 1 million tons.

J. D. FARRINGTON,
President.

CHICAGO, University of. An institution of higher education and research, located at Chicago, Ill.; founded in 1890; privately endowed; coeducational and nondenominational.

The university includes the following departments: the college; the four divisions—humanities and the social, biological, and physical sciences; and the six professional schools—Divinity, Law, Business, Graduate Library, Social Service Administration, and the Medical School.

In 1942, after five years of experimentation in University High School and 12 years with the "Chicago Plan," collegiate work was relocated. Students are admitted to the college at the end of the sophomore year of high school for a four-year program of general education; on its completion, the bachelor's degree is granted. Qualified students may enter at any level and be placed in the appropriate classes through a system of placement tests given upon entrance to determine the educational achievement of each student in relation to the college's definition of general education. Students satisfy degree requirements by passing 14 comprehensive examinations, or by being excused through the placement tests. The program of work for the master's degree is a three-year program. Both master's degree and that of doctor of philosophy are granted in the humanities, and the biological, physical, and social sciences.

William Rainey Harper, who had occupied three separate chairs of instruction at Yale University, accepted the presidency in 1891. His first faculty comprised 120 men and women, including nine men who left the presidencies of higher institutions to accept teaching posts with the new university before any student had registered for classes. In 1950, the faculty numbered 1,000.

Between the time of Dr. Harper's death (1906) and 1950, the university had five presidents. The first four were Harry Pratt Judson, Ernest De Witt Burton, Max Mason, and Robert Maynard Hutchins. At the time of his acceptance of the presidency in 1929, Mr. Hutchins was the youngest university president in the United States. The educational policies enunciated at his inauguration and since put into effect made him a vigorous leader in educational improvements; his analyses of world affairs made him internationally known. In June 1945, the trustees changed Mr. Hutchins' title to chancellor. On the same date, Ernest Cadman Colwell became president, responsible to the chancellor for the educational operations of the university.

The decision which brought the atomic bomb research to the university was made by Mr. Hutchins. The self-sustaining nuclear reaction, in the world's first "pile" under the west stand of Stagg Field, on Dec. 2, 1942, was the first product of the decision. Before World War II was over, Chancellor Hutchins gathered the chief men of his undertaking into three new research institutes for peacetime nuclear, biological, and metal research. Included among the men were two Nobel Prize winners, Harold Clayton Urey and Enrico Fermi. James Franck, professor of chemistry, became a third Nobel Prize winner on the university staff. With a \$12,500,000 program, the three institutes constituted the largest privately-supported atomic research undertaking in 1950. The United States Navy provided most of the cost of the \$2,200,000 synchrocyclotron; and, as of 1950, industrial corporations were the source of \$650,000 a year in support of the program. The Argonne National Laboratory, near Chicago, is also operated by the university, under a contract with the United States Atomic Energy Commission; 29 midwestern institutions, including the university, cooperate in the research program.

The university's medical and biological research center is unique. The medical school is the only school in the United States with a staff devoting full time to medical teaching and research, and engaging in no practice except in the university's clinics.

CHICAGO AND ALTON RAILROAD, a pioneer western railroad. Its first segment was chartered in 1847, and it was completed from Chicago to Kansas City, Mo., in 1879. In 1947 it became part of the Gulf, Mobile and Ohio Railroad.

CHICAGO AND NORTH WESTERN RAILWAY SYSTEM, a railroad system comprising the Chicago and North Western Railway Company and the Chicago, St. Paul, Minneapolis and Omaha Railway Company. The C&NW assumed control of the latter in 1925 through ownership of capital stock. The system serves Illinois, Wisconsin, the upper peninsula of Michigan, Minnesota, Iowa, North Dakota, South Dakota, Nebraska, and Wyoming. The double-track Chicago-to-Omaha line connects with the Union Pacific, forming part of a transcontinental route. The parent company (C&NW) was organized June 7, 1859, by the purchasers of the Chicago, St. Paul and Fond du Lac Railroad, which had been sold at foreclosure on June 2 of the same year. Following this there was a series of consolidations and acquisitions, of which the

most important were the Galena and Chicago Union Railroad (1864), the Peninsula Railroad of Michigan (1864), the Elgin and State Line Railroad (1883), the Chicago, Milwaukee and North Western Railway (1883), the Sioux City and Pacific Railroad (1901), and the Fremont, Elkhorn and Missouri Valley Railroad (1903).

CHICAGO GREAT WESTERN RAILWAY COMPANY, a system operating in Illinois, Iowa, Minnesota, Nebraska, Kansas, and Missouri. The company had its beginning with the charter issued in 1854 to the Minnesota & Northwestern Railway; but no construction was undertaken until 1884, when Alpheus Beede Stickney, founder and first president of the Chicago Great Western, began construction of its first unit of track, 109 miles from Lyle to St. Paul, Minn. Subsequently the road was extended by construction, through consolidation, and by acquisition. Train service commenced to Chicago in 1887, to St. Joseph and Kansas City, Mo., in 1889, and to Omaha, Nebr., in 1904. Its main line, then known as the Chicago, St. Paul & Kansas City Railway (company, incorporated in 1886) and extending from Des Moines, Iowa, to St. Joseph, Mo., was built in 1887 and 1888. The present name was adopted July 1, 1892.

CHICAGO HEIGHTS, city, Illinois; 1 Cook County; altitude 694 feet; 27 miles south of Chicago; on the Chicago and Eastern Illinois Railroad and having freight service over several other railroads via the Chicago Heights Terminal Railroad. The city has extensive industries. There is a Carnegie public library. First settled at a junction of trails about 1833, Chicago Heights became a city in 1901. Government. Pop. (1950) 24,700.

CHICAGO NATURAL HISTORY MUSEUM (formerly FIELD MUSEUM OF NATURAL HISTORY), founded by the famed merchant, Marshall Field,¹ in 1893 with a gift of \$1,000,000, which was augmented by contributions from other Chicagoans.

The museum is divided into four departments—anthropology, botany, geology, and zoology, each with many specialized divisions. The collections assembled in each of these have raised the institution during its comparatively short span of existence to a rank rivaled only by three other natural history museums in the entire world—those in Washington, New York, and London, all established many years earlier. In many fields, Chicago Natural History Museum possesses collections not duplicated anywhere else. It has been built up through the years by the work of scientists who have conducted more than 600 expeditions in nearly all parts of the world. Concurrently with the collecting and preparation of exhibits, a vast amount of diversified research has been carried on which has expanded the sum total of human knowledge.

In addition to the four scientific departments, the museum maintains an important library, operates a publishing plant to produce scientific books and periodicals, and conducts a broad program of service to the public. Two separately endowed foundations within the museum are devoted to the science education of children. One of these keeps a constant succession of hundreds of miniature traveling natural history exhibits in circulation among all the schools of Chicago; the other

provides extension lectures, films, slides, and other aural and visual facilities.

CLIFFORD C. GREGG.

¹At his death in 1906, Field bequeathed \$8,000,000 more to the museum; total endowment today is approximately \$12,500,000.

CHICHEN ITZA, *chê-chân' êt-sâ'*, the largest archaeological zone in Yucatán, Mexico, and one of the most important in the New World, situated 72 miles east-southeast of Mérida, with which it is connected by a highway.

History.—Chichén Itzá originated as a northern outpost of the Maya Old Empire and was settled by the Itzá people in 514 A.D. (S. G. Morley's chronology; see end of article) near two great *cenotes*—natural wells supplied with underground water—so necessary to life in this semiarid region. The very name Chichén Itzá means "at the mouth of the well of the Itzá," a reference to the Sacred Well. Abandoned in 692, the site was reoccupied by the Itzá in 987; this time jointly with a Mexican (possibly Toltec) group under Kukulcán, who was perhaps later deified as the feathered serpent. A renaissance of Maya civilization took place, and in 1007 the three great cities of the New Empire, Chichén Itzá, Mayapán, and Uxmal, formed the League of Mayapán. The culture of Chichén Itzá and Mayapán, which was settled from Chichén Itzá, was Maya-Mexican, while the beautiful buildings at Uxmal show a more purely Maya origin. During the period of the League of Mayapán, Chichén Itzá, the holy city of the Maya, with its Sacred Well, was the object of pilgrimages from all parts of the Maya world and beyond. El Castillo, the Ball Court, the Temple of the Jaguars, and the Observatory date from this period.

Rivalry among the cities, however, led to a civil war in which Chichén Itzá was subjugated (1194) by Mayapán, which employed Mexican mercenaries. The period of Mayapán's domination was ended by a revolt of the Maya lords under the leadership of Uxmal, and Mayapán was sacked (1441), after which the New Empire civilization declined and the great cities were abandoned, the Itzá returning southward to settle around Lake Petén, now in Guatemala.

The principal excavations and reconstructions at Chichén Itzá were conducted by the Mexican Ministry of Public Education, and by the Carnegie Institution of Washington, D.C. under the direction (1924–1940) of Sylvanus Griswold Morley.

Principal Buildings.—Most of the buildings rest on earth-filled terraces faced with light gray stone; the columns and many of the walls are sculpted in bas-relief or—in the case of other (generally older) walls—are decorated by the fitting together of innumerable small pieces of stone to form geometric patterns or faces of the all-important rain god Chac, with his "elephant trunk" nose curling out from the wall in a single piece of stone. In their original condition the bas-relief sculptures were painted brilliant greens, reds, and yellows, so that the appearance of the city must have had an almost barbaric splendor.

El Castillo (The Castle), or the Temple of Kukulcán, is a steep, truncated pyramid, 184 ft along the base of each of its four sides, 84 ft high, with a two-chamber temple on top. The pyramid rises in a series of narrow, stone-faced terraces which are divided on each of the four sides by a broad stairway with wide balustrade.

the balustrades of the main (north) stairway and in two huge serpent heads on the ground, with open mouths and protruding tongues.

This structure was built over an older pyramid. The latter is reached by a tunnel which follows an excavated portion of the stairway of the inner pyramid to its top. Here, under the platform of the outer pyramid, is the chamber containing the celebrated Red Tiger Throne, a monolithic limestone jaguar painted red and inlaid with jade disks to represent its eyes and fangs.

The Ball Court consists of two immense, parallel, smooth stone walls, 274 feet long and 20 feet apart; the court being open at two ends. The object of the game was to use any part of the body except the hands to knock a rubber ball through a stone ring, two of which, entwined with serpents, are set opposite each other high in the center of the walls. Bas-relief sculptures along the base of the walls depict various richly attired dignitaries, one of whom has been depicted, facing a disk bearing a death's head.

The Temple of the Jaguars stands above the south end of the Ball Court. Within are two chambers, the inner one notable for its wall paintings showing scenes of daily life. There are carvings of warriors attacking a town, women at work, and utensils very similar to those inhabited by the modern Maya of Yucatán.

The Sacred Well, into which pilgrims cast sacrificial offerings, including human beings, is a deep, circular hole, 165 feet in diameter, and about 100 feet deep; the depth of the water varying from 15 to 35 feet. The second well, the *stoloc* (small lizard) *cenote*, of about the same dimensions, is in the second division of the zone.

The Temple of the Warriors is a magnificent structure, a series of terraces with a walled, but roofless, temple on top. It is ascended by a wide stairway and entered between two lofty columns in the form of serpents. At its foot is a veritable forest of four-sided columns composed of square stone blocks laid one on the other and beautifully sculpted with human figures. Under the Temple of the Warriors are two earlier structures; the first a small pyramid closely resembling El Castillo in shape, the second another temple containing a chamber in which are frescoes and a number of columns like those at the foot of the outer temple, with the difference that these are so well preserved that their coloring is distinct and affords a clue to the original appearance of those outside. While the other temples mentioned are roofed with stone and earth by means of corbel arches, the material used to roof this temple and to cover the columns below it remains a matter of conjecture.

The Observatory (or El Caracol), perhaps the most interesting structure in the entire zone, was probably used as an astronomical observatory. It is a round tower 22 feet in diameter, with a dome-shaped top, 24 feet high overall. The tower rests on a smaller terrace which in turn rests on a larger one 208 feet long, 150 feet wide, and 17 feet high. Both are ascended by wide stairways with balustrades of entwining serpents. In the center of the tower is an immense column of stone blocks which is surrounded by two circular walls, each penetrated by four doorways. There is also a low, winding stairway (caracol, in Spanish) which gives access to the upper part.

The Nunnery (Casa de las Monjas), a large

building of several rooms, probably a palace, rests on a terrace 32 feet high, and is reached by still another wide stairway. The most interesting building nearby is the small El Templo (The Temple) on the east side at ground level. Its exterior is covered with an incredibly intricate design of small pieces of fitted stone, the dominant motif being a repetition of faces of the rain god Chac.

Heaps of ruined mounds, fallen walls, and sculptured blocks, as well as dozens of other buildings of lesser interest, more or less well preserved, scattered over the area show that the completely ruined part of the city is vastly larger than the part still standing.

Consult Morley, S. G., *The Ancient Maya* (Stanford, Calif., 1946).

CHICHESTER, chích'is-tēr, Arthur, BARON CHICHESTER OF BELFAST, English administrator; b. Raleigh, Devonshire, England, May 1563; d. Feb. 19, 1625. He was educated at Exeter College, Oxford, where he matriculated on March 15, 1568. In 1588 he was captain of one of the English ships sent against the Spanish Armada. He was probably on Sir Francis Drake's last voyage in 1595, and in 1596 and 1597 participated in military operations against Spain.

Robert Devereux, 2d earl of Essex, named him governor of Carrickfergus, Ireland, in 1599, and he later played a big role in campaigns against the feudal lords of the country and in the making of policy to be used in governing Ireland. On Feb. 3, 1605, he assumed his duties as lord deputy of Ireland. He abolished traditional privileges of the native lords and made their dependents subjects of the king of England. At the instigation of James I he tried to decrease the influence of the Roman Catholic church in Ireland. The persecutions involved in carrying out this plan were relaxed in 1607 on the advice of Chichester. However, his ideas about dividing the lands of Ulster, abandoned by their Irish lords, were not followed. Chichester wanted the natives to benefit first in such land grants, the English and Scottish planters to share any surplus. In 1614 he was again urged to take measures against increasing Roman Catholic influence. Recalled later that year, he was restored to favor in 1616, being appointed lord treasurer of Ireland.

CHICHESTER, chích'is-tēr, municipal borough, England; county seat of West Sussex, 16 miles east-northeast of Portsmouth. It is well built and has wide streets. Its old wall, most of which is still standing, is lined with elms and gives the town a very picturesque appearance. The cathedral is chiefly Early Norman and was built mainly between about 1090 and 1123. It has one of the most graceful spires in the country, and a detached bell tower, Perpendicular in style, which is the only one still standing in England. There is also a fine octagonal market cross built about 1500.

The site of Chichester was known as Regnum during the Roman occupation, and was the headquarters of Vespasian. It was captured by the Saxons in the 5th century, and renamed Cissacester for the Saxon king, Cissa. It was important throughout the Middle Ages and during the great civil war changed hands three times in 13 months (1642-1643). Pop. (1951) 19,110.

CHICK-PEA, the popular name of *Cicer*

arietinum and other plants of the same genus cultivated in Asia, Latin America, and around the Mediterranean. They are leguminous plants of the pea family well suited to dry climates, and produce a short puffy pod with generally two small wrinkled seeds, eaten boiled or roasted.

CHICKADEE. See **TITMOUSE**.

CHICKAHOMINY, *chik-ä-höm'i-ni*, river in eastern Virginia, about 90 miles in length. It is an affluent of the James and runs parallel to it for many miles from its source 16 miles northwest of Richmond. Many engagements of the Civil War took place along its course.

CHICKAMAUGA, *chik-ä-mò'gä*, **Battle of**, fought near Chickamauga Creek in northwest Georgia on Sept. 19-20, 1863. Chickamauga, a major battle and a Federal defeat, was indecisive in terms of the campaign of which it was a part. The size of the armies and the intensity of the fighting, however, made it one of the famed battles of the Civil War. It was outstanding for military reputations won and lost.

The campaign opened in early summer of 1863, with the Federal and Confederate armies facing

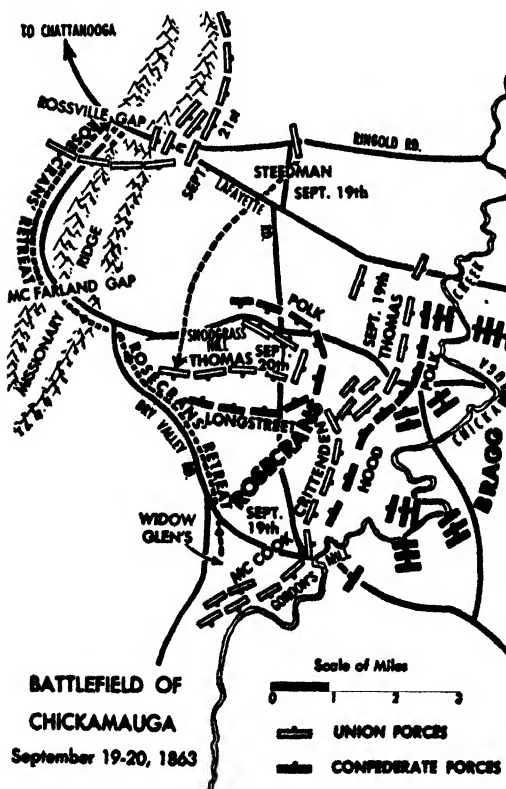
general, Braxton Bragg, had had considerable experience in independent command and was aggressive in spirit. His operations, however, were inclined to display disorganization and his relations with his subordinates left much to be desired. Both Rosecrans and Bragg suffered from that lack of adequate staff that characterized all the armies of the war until the final year. Staff is important for the gaining of intelligence and for communication. The course of the fighting at Chickamauga was conditioned by failures both of intelligence and communication, particularly in the Federal army.

What has been called the campaign of Chickamauga opened on June 24, 1863, when Rosecrans moved out of Murfreesboro, with Chattanooga as his objective. For weeks, as Gen. Robert E. Lee drove northward from Chancellorsville, Henry Wager Halleck, general in chief in Washington, had urged Rosecrans to take the offensive to put pressure on the Confederate forces that, in effect, guarded Lee's rear. At the same time, Rosecrans had complained of lack of men and supplies. Once in motion, however, he directed a brilliant campaign of maneuver. With well-conceived feints and flanking marches he forced his adversary without a battle out of southern and eastern Tennessee and into northwestern Georgia. In the early weeks of the campaign Bragg had been handicapped by a shortage of men, his army having been reduced to provide reinforcements for the defense of Vicksburg which fell on July 3, nine days after Rosecrans began to move. As Bragg retired, his army grew as troops no longer needed in the Vicksburg area were added to his force. In spite of Bragg's growing strength, Rosecrans forced him back by skillful maneuver and on September 9 entered Chattanooga without a battle. It was a great achievement, for Chattanooga, a railway center binding together the Confederate east and west, possessed a strategic importance if anything greater than Vicksburg.

Rosecrans believed Bragg to be on the run and decided to pursue and, if possible, to destroy him. But the Confederates were far from defeated. President Jefferson Davis, aroused by Southern reverses at Gettysburg and Vicksburg, made strenuous efforts to have Bragg check and throw back the Federal thrust at Chattanooga. He arranged for reinforcements for Bragg, even detaching Lieut. Gen. James Longstreet's corps from Lee's Army of Virginia and sending it by rail to Bragg. Because of the scarcity of railroads in the South, Longstreet's men had to come from Virginia by way of Charleston, S. C.

The actions that followed the occupation of Chattanooga were conditioned by the nature of the terrain about that town. The city lies in the western edge of the broad Appalachian mountain system that in the 1860's divided the Confederacy into two parts. The mountains in this region consist of rugged parallel ridges covered at the time of the Civil War by forests of scrub oak and pine, broken here and there by small clearings where isolated farmers eked out a subsistence. Two of these homesteads, those of the Widow Glen and of Snodgrass, achieved a place in history by being on the Chickamauga battlefield. Widely separated gaps permitted main highways to cross the ridges, though some mountain roads surmounted their crests. Uplands and woods made the country difficult and, to make matters worse, neither Federals nor Confederates had adequate maps.

Rosecrans, in possession of Chattanooga and believing Bragg to be retreating eastward along



another near Murfreesboro, Tenn. In June 1863, Lee, after his victory at Chancellorsville in Virginia, was advancing northward to invade Pennsylvania. Grant, on the Mississippi, was striking toward Vicksburg, Miss., the last important Confederate crossing point for supplies from Texas and Arkansas. Maj. Gen. William S. Rosecrans, commander of the Union Army of the Cumberland at Murfreesboro, knew well the art of war but lacked the force of character to exercise leadership in an emergency. The Confederate

the railway that led to Charleston, ordered on September 9 a "general pursuit." The Federals planned to continue the feinting and flanking tactics that had worked so well in the more level country west of the ridge that separated Chattanooga from central Tennessee. Rosecrans despatched his three corps, under major generals Alexander McD. McCook, Thomas L. Crittenden, and George H. Thomas respectively in a general easterly and south-easterly direction through mountain passes separated from one another by many miles. When Rosecrans made this decision to divide his army, he did not know the location of Bragg's force. The offensive spirit that dominated the Rosecrans headquarters is illustrated by the orders sent to Crittenden, whose corps was advancing along the railroad: "Be ready to attack the enemy with the utmost vigor." Three days after the "pursuit" had begun each corps had virtually reached its first designated objective and Rosecrans' army was spread over 50 miles of hilly, wooded country connected only by primitive roads. Only Thomas, advancing near Chickamauga Creek, had met opposition. On September 11 a strong Confederate force had attached Thomas' advance guard and had driven it back on the main body. Informed of this action, Rosecrans suddenly became aware that he faced a situation vastly different from the one he had assumed when he made his plans.

Bragg, whose army had been greatly augmented, after evacuating Chattanooga had retired into the rough country as far as Chickamauga Creek where he stopped and made ready to fight. Some of his troops were newly arrived and many of his subordinates were strangers to one another. Longstreet's corps was on the way and did not report for action until the night of September 19. With that addition, Bragg had a force of about 73,000 men. Rosecrans opened the battle with a nominal strength of about 55,000, of whom 10,000 were mounted.

On September 12 Bragg had the opportunity to attack the dangerously extended army of his adversary, one corps at a time. His failure to do so was a military blunder equal in magnitude to that of Rosecrans in rashly dispersing his troops in mountainous country without first being sure of his enemy's whereabouts and whether or not he was in retreat. Rosecrans, grasping the danger of his situation, ordered McCook and Crittenden to hurry their troops to positions beside Thomas. They concentrated through Rossville Gap through which ran the highway from Chattanooga to Lafayette, Tenn. On September 18 the Federal army, wearied by forced marches, stood united with its back to Missionary Ridge facing Bragg concealed in the woods on the eastern side of Chickamauga Creek. Rosecrans had rectified his error, but he was near exhaustion when the concentration was completed.

On September 19 the Federal line, running more or less along the Chattanooga-Lafayette road, consisted of Thomas on the left (north), Crittenden in the center, and McCook on the right (south). Bragg seized the offensive, directing assaults primarily against Thomas with what Thomas believed to be the intention of driving back the Federal left to open the way for a flanking movement to Rossville Gap and the Federal rear. September 19 was a day of hard and often confused fighting in woods and thickets. Civil War tactics still called for fighting in close order formation, a style much hampered by wooded

terrain. Darkness brought an end to a bloody contest in which neither side had gained any decisive advantage. Rosecrans prepared for defensive battle on the following day, estimating correctly that his enemy outnumbered him. Even as the fatigued Federal commander made his plans, Longstreet arrived with his corps of veterans from Gettysburg. Bragg placed him on the Confederate left.

In the forenoon of September 20 the Confederates again forced the fighting. Again Thomas found himself hard pressed. Rosecrans, to prevent his army from being outflanked on the left, sought to transfer units from the Federal center and right so as to provide Thomas with the means to hold. A series of unfortunate occurrences prepared the way for catastrophe. The first of these was the failure of McCook to obey an order from the commanding general to send a particular unit to Thomas, a failure that multiplied Thomas' worries. Then, as the battle roared to a climax in the latter part of the morning, a unit sent to the aid of the Federal left became confused by the terrain and the situation and took up a position where it was of no immediate use. Finally, erroneous information came to Rosecrans' headquarters, resulting from a Federal officer's hasty and incomplete observation, that a gap existed in the center of the Union line. Up to this time, the Federal center and right had not been seriously engaged. Rosecrans, acting hastily and without investigation, issued an order to a unit commander that gave the subordinate no explanation of why the order was issued or discretion, if it should prove to be unwise in view of his immediate local situation. As a result the subordinate moved out of the line leaving behind a genuine gap.

Almost immediately Longstreet struck the Federal center. The triumphant Confederates poured through the gap, at the same time attacking the right. McCook's corps and that of Crittenden fell back in rout along Dry Valley Road. Rosecrans, who had placed his headquarters at Widow Glen's behind McCook, was swept along in what became a stampede. The commanding general rode headlong through McFarland's Gap to Chattanooga to prepare a last ditch defense of his base. Completely unnerved, he wired Lincoln that his force had suffered disaster.

In sending the message Rosecrans had again acted without adequate information. His later reputation would have been better had the commanding general personally undertaken to do what his chief of staff, Brig. Gen. James A. Garfield, asked and got permission to do. Vague information coming to Chattanooga suggested to Garfield that Thomas still fought in his original position. Garfield, riding back to the battlefield, verified the report and joined Thomas at the latter's headquarters on Snodgrass Hill. When the Federal center and right gave way, Thomas had formed his forces in a horseshoe so placed as to protect both his flanks and to command every vital road. He held his ground until night came, thereby winning the designation, "Rock of Chickamauga." Garfield informed Rosecrans of the situation. When the fighting ended, Rosecrans, resuming control of the army, ordered Thomas to fall back to Rossville Gap where defensive positions would be very strong.

So the Chickamauga campaign, that had begun so auspiciously for the Union, ended with the Federal army confined in Chattanooga besieged by

Bragg. Rosecrans, so shaken as to be unable to function effectively, permitted the Confederates to close all the main supply routes from Tennessee. The siege, therefore, promised Bragg the possibility of complete success. Such supplies as the desperate Federals managed to get into Chattanooga had to be hauled over rough mountain roads that crossed the crest of the ridge lying west of Chattanooga. The Army of the Cumberland to which Rosecrans was unable to bring order faced starvation.

Lincoln acted to remedy the situation by designating Grant, conqueror of Vicksburg, commander of all the Federal armies save one, in the western theater. Grant promptly relieved Rosecrans, putting Thomas in his place. The new commander at Chattanooga, demonstrating as much ability in cantonment as in the field, re-established order, improved the supply position, and held until Grant could send reinforcements and come in person to establish his headquarters at Chattanooga.

The battle had shattered the reputations, not only of Rosecrans but of McCook and Crittenden whom Rosecrans had relieved before the end of the battle. Also dissension, after the battle, demoralized the Confederate force. Bragg's handling of the engagement had caused him to forfeit the confidence of all his chief subordinates. They made bitter reports to President Davis who hurried from Richmond to investigate the situation in person. He found Bragg as critical of his generals as they were of him. Though the president still retained confidence in Bragg, he offered the command to Lieut. Gen. William J. Hardee and to Longstreet. Both refused; and Davis declined to appoint Gen. Joseph E. Johnston whom Longstreet suggested. So Bragg retained his post. He commanded the army when Grant moved out of Chattanooga in December and smashed his force.

Chickamauga was one of the bloodiest battles in a war characterized by heavy losses on the battlefield. Rosecrans lost in killed, wounded, and missing more than 16,000 men, Bragg about 18,000. For troops actually engaged, this represented a percentage of 33 for each side.

Consult *The War of the Rebellion: a Compilation of the Official Records of the Union and Confederate Armies*, vol. 23, parts 1 and 2; vol. 30, parts 1, 2, 3, and 4 (Washington 1880-1901); Hosmer, James K., *The American Civil War*, vol. 2, chap. 2 (New York 1913); Smith, Theodore C., *The Life and Letters of James Abram Garfield*, vol. 1, chaps. 9, 10 (New Haven 1925).

RALPH HENRY GABRIEL,
Yale University.

CHICKAMAUGA AND CHATTA-NOOGA NATIONAL MILITARY PARK, Georgia and Tennessee, oldest and largest of the national military parks, was established to preserve the scene of the Civil War battles fought for control of Chattanooga, Tenn., and as a memorial to both the Northern and Southern forces who fought so heroically in the battles. Located at a gap in the mountains through which flows the Tennessee River, Chattanooga was an important railroad junction at the time and a key to the communications system of the Southern Confederacy.

The park is composed of separate areas, the more important of which are Chickamauga Battlefield; Point Park and the Battlefield of Lookout Mountain, and Orchard Knob, in Chattanooga; a chain of small reservations located on Missionary

Ridge; and Signal Point on Signal Mountain. The park contains approximately 8,000 acres of federal land, about 6,300 of which are in Georgia, the remainder in Tennessee.

From the terrace of an observatory and museum at Point Park on the north end of Lookout Mountain, high above the winding Tennessee River, park visitors obtain a comprehensive view of the Battlefield of Chattanooga. Markers identify the more important troop positions, and maps are available indicating the natural and historic features of interest. This structure is a memorial to Adolph S. Ochs, publisher of the *Chattanooga Times* and the *New York Times*. He was a leader in the movement that resulted in establishment of the park and was responsible for the acquisition of considerable land on Lookout Mountain for park purposes.

From its establishment in 1890 until 1933, when it was transferred to the jurisdiction of the National Park Service, the park was administered by the War Department.

CHICKAREE, chīk'ā-rē. See **SQUIRREL**.

CHICKASAW, chīk'ā-sō, a small American Indian tribe of Muskogean stock, closely related to the Choctaw and speaking a different dialect of the same language. The original homeland of the Chickasaws during historic times was northern Mississippi and adjacent parts of Alabama and Tennessee. They were an energetic, warlike people; but although of marked ability, they were—because of their relative remoteness from white settlements—slower than their Choctaw kinsmen to adopt civilized customs.

Their first contact with Europeans was with the De Soto expedition, which spent the winter of 1540-1541 near their villages and was badly crippled in a battle with their intrepid warriors the following spring. For the next century and a half they were almost undisturbed. Then at about the year 1700 English traders penetrated to their country and the French began making settlements near the mouth of the Mississippi. The Chickasaws allied themselves with the English and fought the Choctaws and other tribes under French influence; but when the American Revolution broke out, some of their warriors served in the American armies. They made their first treaty with the United States in 1786 at Hopewell, on the Keowee River in South Carolina.

During this period they received considerable admixture of white blood from English and Scotch-Irish traders and others who settled in their country and married Chickasaw women. In 1819 Presbyterian missionaries began to work among them. A careful estimate made in 1822 set their population at 3,625; they were then living in eight settlements, farming and raising livestock. Some of them, especially those with mixed blood, had acquired Negro slaves.

But the pressure of the white frontier forced them to cede outlying tracts of their land during the early 1800's. Finally in 1832 they agreed to surrender the remainder and remove to the west of the Mississippi as soon as they could find a suitable location. They sent out several exploring parties without success, and the government became impatient. Finally in 1837 they were induced to sign a treaty with the Choctaws, by which for a consideration of \$530,000 they obtained the right to join that tribe.

The Choctaws at that time owned the southern half of Oklahoma, but their settlements—made after their own removal a few years before—were in the eastern portion of their domain. The Chickasaws at first made their homes among them, but eventually formed a district of their own farther west. They made some ineffectual efforts to build schools and set up a local government in their district, but mainly they marked time, unwilling to be merged with the larger tribe. A separation was finally effected in 1855, though the two peoples continued to own their land in common.

The Chickasaws then created an independent government with a governor, a legislature of two houses, and a system of courts. They established neighborhood schools and boarding schools, and even encouraged attendance by a regular payment to the parents. At a place they named Tishomingo they erected a brick capitol, later replaced by a sturdy stone building now used as a county courthouse. They became a Christian people. Some of their Presbyterian churches have held centennial celebrations recently.

With the Choctaws they joined the Confederacy in the Civil War. As a punishment the two tribes were to cede more than one third of their territory, the tract lying west of the Chickasaw district. They were to receive payment for this cession if they would grant citizenship to their former slaves; otherwise the government would colonize the Negroes elsewhere and use the money for them. The Chickasaws steadfastly refused the grant of citizenship, but the United States failed to carry out its part of the contract; hence the freedmen remained in their country with no legal status.

Some of the richest agricultural land in Oklahoma lay in the Chickasaw district. This fact and the small tribal population invited white immigration after the Civil War—men who came in as railroad builders, town builders, cattlemen, and farmers. Some became intermarried citizens, others paid a tax to the tribe, more were simply intruders. When the first federal census was taken in 1890, it enumerated 48,421 white people, 3,676 Negroes, and only 5,223 Indians. All this alien population was without government or schools or legal land tenure.

The federal government accordingly liquidated the affairs of the tribe. In the division of property each citizen received an allotment of land varying from 160 to 4,165 acres according to its quality, and \$1,425 in cash. Allotments were also made to the freedmen, but the Chickasaws protested and carried their case to the courts; and the United States Government was required to pay them for the land thus misappropriated.

The Chickasaws became citizens of the United States, and at statehood in 1907, citizens of Oklahoma. Many have become prominent. Johnston Murray, who became governor of the state in 1951, is of Chickasaw descent. A few fullblood settlements may still be found in remote places in south central Oklahoma. See also CHOCTAW.

Consult Wright, Muriel H., *A Guide to the Indian Tribes of Oklahoma* (Univ. of Oklahoma 1951).

ANGIE DEBO,
Librarian, Oklahoma Agricultural and Mechanical College.

CHICKASAW, chik'a-só, city, Alabama; in Mobile County; 6 miles north of Mobile; altitude 40 feet. It is situated on Chickasabogue

Creek, an affluent of the Mobile River, and is connected with Mobile Bay by a 25-foot channel. Chickasaw is served by the Southern and the Alabama, Tennessee and Northern railroads, the Terminal Railway Alabama State Docks, and has a class-1 airport. Located in a lumbering region, its main activities are shipbuilding and fishing. The city was incorporated in 1946. It has a mayor and council form of government. Pop. (1950) 4,920.

CHICKASAW BAYOU or BLUFFS, Battle of, a Union defeat during Gen. U. S. Grant's ultimately successful campaign against Vicksburg, Miss., fought Dec. 29, 1862. On Dec. 8, 1862 Grant ordered Gen. W. T. Sherman to organize at Memphis, Tenn., an expedition which in cooperation with Adm. D. D. Porter's gunboat fleet should reduce Vicksburg. On the 22d the expedition rendezvoused at Friar's Point on the Mississippi, ready to move up the Yazoo River in rear of Vicksburg. Sherman had the four divisions of Gens. F. Steele, Geo. W. Morgan, M. L. Smith and A. J. Smith, aggregating about 30,000 men. The transports, preceded by the gunboats, entered Yazoo River on the 25th, and on the 26th and 27th the troops were landed on its south bank, confronting the bluffs overlooking the swamps through which ran Chickasaw Bayou. Gen. J. C. Pemberton, commanding the Confederate forces in Mississippi, was at Grenada opposing Grant, who was moving south from Grand Junction and Corinth on the line of the railroads. On the 21st Pemberton heard that the fleet and transports were moving down the Mississippi for the supposed purpose of attacking Vicksburg, which at the time was held by Gen. Martin L. Smith with the brigade of Gen. S. D. Lee. Vaughn's brigade was immediately ordered to Vicksburg, and was soon followed by the brigades of Gregg and S. M. Barton. Pemberton arrived at Vicksburg on the 26th and the last of the three brigades during the night of the 27th. Pemberton disposed his forces, under Vaughn, Gregg, Barton and Lee, on a line from Vicksburg on the left to Haynes' Bluff on the right, a distance of 13 miles, on high ground overlooking Chickasaw Bayou and the Yazoo River, S. D. Lee holding Walnut Hills from Vicksburg to Snyder's Mill on the right, a distance of 10 miles. Lee, a good engineer and a fine officer, strengthened his position by works for his batteries and rifle pits on the slope of the bluff, which rose about 200 feet above the bayou. Between this position and where Sherman had landed was bottom land, almost wholly densely wooded, intersected with bayous and low, swampy ground. There were but three roads through this area, and these were obstructed by earthworks and felled timber. By these Sherman advanced on the morning of the 27th, Steele on the left, Morgan on the right of Steele and M. L. Smith and A. J. Smith on the right of Morgan. There was heavy skirmishing on the 27th and 28th, the Confederate outposts were driven in, and on the night of the 28th the Union troops lay parallel to Chickasaw or Walnut Hills bluff and about 600 yards from its foot. The main assault on the bluff was to be made by Morgan, supported by Steele; while, to make a diversion in favor of Morgan, A. J. Smith, with M. L. Smith's division and one brigade of his own, was to cross a lake, a mile below Morgan, by a narrow sand bar, and attack. On the extreme right the rest of

A. J. Smith's division was to demonstrate on the road to Vicksburg. On the morning of the 29th Morgan represented to Sherman that an attack from his position was impracticable; but Sherman, after an examination, rode off to his headquarters, whence he sent his adjutant general to Morgan with this message: "Tell Morgan to give the signal for assault; that we will lose 5,000 men before we take Vicksburg, and may as well lose them here as anywhere else." Morgan replied that Sherman's entire army could not carry the position in his front, but that he would order the assault. De Courcy's brigade of Morgan's division, and the two brigades of Blair and Thayer of Steele's, were formed for the assault. The signal was given by a heavy artillery fire upon the Confederate lines, and at 12 o'clock the three brigades went forward. By some misunderstanding Thayer's brigade, with the exception of the 4th Iowa, diverged too far to the right, but De Courcy, Blair and Thayer (with the 4th Iowa), about 6,000 men, after clearing the obstruction in front and floundering through deep mire and tangled marsh, under a terrific fire of artillery, finally made a lodgment on the hard tableland at the foot of the bluff, where an abandoned line of works gave shelter, and where some of the men stopped. All formation was broken up, brigades and regiments mixed, but on went the main body, pushed up the bluff, and reached different points of Lee's works, where they were met on both flanks by such a withering fire from the rifle pits that ran diagonally up the slope of the hill, and so severe a cross-fire of shell and canister from the batteries, that the men faltered and, no support being in sight, fell back to the point of starting, leaving about 1,500 killed, wounded and captured. Lee lost 115. More to the right, where A. J. Smith was to demonstrate, the 6th Missouri gained the levee at the foot of the bluff, but not able to go farther under the hot fire poured upon them from above, the men sought shelter by digging with hands and bayonets into the bank of the levee, where they remained until night covered their withdrawal, after a loss of 57 killed and wounded. Sherman thought of renewing the assault in the morning, but after a personal examination, he came to the conclusion that the enemy's center could not be broken without crippling his army beyond the power to act with any vigor afterward, and proposed to attack Haynes' Bluff, higher up the Yazoo. Preparations were made to assault at 4 o'clock on the morning of Jan. 1, 1863. Admiral Porter, who was to cooperate in this attack, found the fog so dense on the river that he could not move his boats. The attack was deferred and then abandoned, and by sunrise, January 2, the troops were all embarked on transports and sailed for Milliken's Bend. The Union loss in the assault on Chickasaw Bluffs and in the skirmishing preceding it was 1,213 killed and wounded, and 563 missing. The Confederate loss was 177 killed and wounded, and 10 missing.

E. A. CARMAN.

CHICKASHA, chik'-a-shā, city, Oklahoma; seat of Grady County; situated at an altitude of 1,094 feet on the Washita River, a tributary of the Red River, 40 miles southwest of Oklahoma City. It is served by the Chicago, Rock Island and Pacific and the St. Louis-San Francisco railroads; Chickasha Airport (municipal) is three miles northwest. The surrounding country, in

the fertile Washita Valley, is predominantly agricultural, with cotton the chief crop, and corn, wheat, alfalfa, and sorghum extensively grown; there are also gas and oil wells. Cotton ginning and production of cottonseed oil are mainstays of the city's industries, with manufactures of flour and feeds, dairy products, farm machinery and oilfield equipment.

Chickasha has a Carnegie public library and is the seat of the Oklahoma College for Women (founded 1908). The city owns and operates its water supply system. Incorporated as a town in 1892, as a city in 1898, Chickasha has the council-manager form of government. Pop. (1950) 15,842.

CHICKEN. See POULTRY.

CHICKEN FLEA, STICKTIGHT FLEA, or **TROPICAL HEN FLEA**, the common name of *Echidnophaga gallinacea*, a pest of young chickens in tropical and subtropical regions, and destructive from Florida to Texas. It is smaller and shorter than the cat flea, with the eyes and antennae in the higher part of the head, and it does not hop. It abounds mostly in shady places, under old houses, and in earthen floors. It is first observed to infest young chickens and turkeys, and by its number and pertinacity kills young chickens, while being more or less permanently parasitic on hens. See also JIGGER; SARCOPSYLLA.

CHICKEN LICE, several species of bird lice (Mallophaga), or louse-like wingless insects, afflicting chickens and hens. Unlike the louse (*Pediculus*), which obtains its nourishment by suction, the bird lice have free jaws adapted for cutting feathers, though they also draw blood from the skin of their host. The large chicken louse (*Goniocotes abdominalis*) is less common than the lesser chicken louse (*G. hollisteri*); it is only one millimeter long, while the first-named kind is three millimeters long. Quite a different kind is the common hen louse (*Menopon pallidum*), which is the most abundant and annoying of all. It differs from the others in its light color and greater activity, running among the feathers and from them upon the hands of persons handling fowls. It is from one to one and a half millimeters long, rather slender and of a pale straw-yellow color. Fowls should be allowed plenty of ashes and road dust in which to roll. An infested henry should be well fumigated and whitewashed, and insect powder should be dusted upon the birds themselves.

CHICKEN MITE, or POULTRY MITE, a small mite (*Dermanyssus gallinae*) which gathers on fowls at night and sucks their blood. It is about one millimeter high, light gray, with dark patches, but red when gorged with blood. It swarms in cracks and corners of the henhouse and should not be confounded with the bird tick (*D. avium*).

CHICKEN POX or VARICELLA, vār-ī-sēl'-ā, an acute, highly contagious, viral disease having mild constitutional symptoms and accompanied by a papular and vesicular eruption appearing in successive crops. The disease was described clinically in 1553 by Giovanni Filippo Ingrassia (1510-1580), and again by William Heberden (1710-1801) about the middle of the 18th century. Heberden differentiated it from

smallpox, with which it had been confused. The elementary bodies found in the fluid from the vesicles, under the microscope, leave no doubt of its viral nature. Mouth lesions are especially likely to spread the disease.

Chicken pox is seen almost exclusively in children and except in infants almost never causes death. One attack usually confers immunity for the life of the subject. The incubation stage is about 14 days, the attack beginning with loss of appetite, mild fever, and within 24 hours the appearance of the eruption. The eruption is most abundant on the trunk and for several days new crops appear. Secondary infection from scratching is common. Most cases are diagnosed easily, but occasionally it is necessary to distinguish it from smallpox by specific tests for the smallpox virus. *Herpes zoster* may resemble chicken pox occasionally.

Treatment is symptomatic. In the very young, restraint may have to be imposed to prevent scratching and scarring.

HAROLD WELLINGTON JONES, M.D.

CHICKEN SNAKE, a name applied to the races of the pilot blacksnake (*Elaphe obsoleta*) that inhabit the Atlantic coastal plain and peninsular Florida in southeastern United States. The name is more often applied to the four-lined chicken snake (sometimes called the yellow rat snake, *Elaphe obsoleta quadrivittata*), long believed to be a distinct species, but now known to interbreed with the gray rat snake (*E. o. coninus*) of the Mississippi Valley, and with the pilot blacksnake to the north. Juveniles of the various races are all blotched or spotted and virtually indistinguishable, but the pattern in the adult chicken snake changes to one consisting of four prominent dark stripes that extend the entire length of the body, with a ground color that is yellow or olive. Chicken snakes occasionally invade poultry yards to devour eggs or prey upon hicks, but small rodents usually comprise the bulk of their fare, with song birds occasionally falling victim. The rat or chicken snakes climb rees or shrubs, possibly in search of bird nests. They are all nonvenomous, and kill their prey by constriction or squeezing.

CHICKEN TICK. The chicken or fowl tick (*Aryas persicus* or *miniatus*) is a first-magnitude pest of domestic fowls and many wild birds in warm areas throughout the world. In the United States its depredations on chickens and turkeys—much less frequently on ducks and geese—cause heavy loss to poultry raisers in the extreme South, and especially in the arid Southwest. The reddish or brown tick has a flattened, obovate body, and the larger female attains a length of nearly one third of an inch when adult. These active parasites hide during the day in dark recesses in or near the henhouses, or cluster under loose bark even at a considerable distance from them. They come out at night, in a fashion similar to bedbugs, to gorge themselves on the blood of the roosting birds, which may be weakened or even killed. They also cause a form of paralysis and are vectors of a very fatal germ disease, fowl spirochaetosis. Control consists of eradication of infestation in the henhouses and the use of creosote and other chemicals to repel or kill the ticks.

CHICKERING. Jonas, American piano

maker: b. Mason Village, N. H., April 5, 1798; d. Boston, Mass., Dec. 8, 1853. He was apprenticed to a cabinetmaker as a boy, and in 1823 began to make pianos in Boston in partnership with James Stewart. The enterprise expanded with the formation of a second partnership (1830-1841) with John Mackay; at Chickering's death his large factory in Boston was turning out 2,000 pianos a year. Among Chickering's improvements was the perfection of the iron frame cast in a single piece (1837).

CHICKWEED, several plants in the family Caryophyllaceae, eaten by birds. Common chickweed, *Stellaria media*, a native of Eurasia, now hugs the heels of man everywhere in temperate waste places.

CHICLANA DE LA FRONTERA, chē-klā'nā thā lā frōn-tā'rā, commune, Spain; in Cádiz Province, 12 miles southeast of Cádiz. It is the center of a vine-growing and pine forest region, and produces chiefly wine and lumber. Chiclana is well built, with many houses of snow-white hewn stone enclosed by gardens. The thermal baths are much frequented. Pop. (1940) 17,047.

CHICLAYO, chē-klā'yō, city, Peru; capital of Lambayeque Department; situated near the Pacific coast, some 400 miles north-northwest of Lima. It is in an agricultural region producing sugar, rice, and cotton, and its chief industries are cotton ginning, and the processing and packing of foodstuffs. Chiclayo is connected by railroad with the ports of Pimental and Eten. Pop. (1940) 32,646.

CHICLE, chik'l, the main ingredient of chewing gum, the coagulated milky latex obtained by tapping the bark of the sapodilla (*Achras sapota*; also called naseberry or chicozapote). The chief sources are the Yucatán Peninsula, and the Mexican states of Chiapas and Tabasco, where the sapodilla grows wild. The latex is boiled and formed into blocks for export, mainly to the United States, where it is refined.

CHICO, chē'kō, city, California; in Butte County; altitude 193 feet. It is situated on the Sacramento River, 80 miles north of Sacramento, is served by the Southern Pacific Company, and has a municipal airport. The county produces almonds, rice, sugar beets, and fruits. The city does fruit and food processing and packing, manufactures beet sugar, and has railroad shops and lumber and cement works. It is the seat of Chico State College, coeducational, founded in 1889. Chico was settled in 1847 and incorporated as a city in 1923. It has a city manager-council government. Pop. (1940) 9,287; (1950) 12,272.

CHICOPEE, chik'ū-pē, city, Massachusetts; in Hampden County. It is situated at an altitude of 92 feet on the east bank of the Connecticut River at the mouth of the Chicopee, 3 miles north of Springfield, and is served by the Boston and Maine Railroad. Formerly a town, the city includes five separate units: Chicopee, Chicopee Falls, Willimansett, Fairview, and Aldenville. It manufactures cotton and knit goods, sporting goods, tires, paper products, firearms, textile machinery, furniture and fixtures and radio parts. Westover Field, an army airbase, is here. Bog iron mining, foundries, friction matches, swords, bronze statuary and doors were important in

Chicopee's early industry. Settled in 1652, it separated from Springfield in 1848 and became a city in 1890. Pop. (1940) 41,664; (1950) 49,211.

CHICOPEE, river, Massachusetts, which rises in Hampden County and flows west into the Connecticut River just above Springfield, Mass. It is formed by the junction of the Swift and Quaboag rivers at the village of Three Rivers 16 miles east-northeast of Springfield. It is an important source of power for towns along its course.

CHICORY, *chik'ò-rí*, or **SUCCORY**, a perennial herb (*Chicorium intybus*) of the family *Chicoriaceae*, native to Europe but carried to many parts of the world as a minor garden and field crop; sometimes escaping from cultivation to become a weed. Its perennial roots store inulin and send up branched stems three to six feet tall with leaves similar to those of the related dandelion, but with numerous showy blue flowers. Leaves of certain varieties are used in salads (Witloof salad and *barbe de capucin* of Continental Europe) and for greens. Chicory roots, from spring-planted seed, are dried, roasted, ground, and used as an adjunct to coffee, the presence of chicory giving the brew deeper color, more lasting flavor and aroma. A cool, humid growing season makes for quality. The endive (*Chicorium endivia*) is a close relation. Most of the United States crop is grown in Michigan.

H. C. RATHER,

Head, Farm Crops Department, Michigan State College.

CHICOUTIMI, *shì-kōò'ti-mì*, town, Province of Quebec, Canada, county seat of Chicoutimi County, on the Saguenay River, 277 miles by Canadian National Railways from the city of Quebec. Its industries include lumber, planing and grist mills, flooring, sash and door, furniture factories, and machine shops. Chicoutimi is an important hunting, fishing, and general tourist center, being the steamship terminus of the picturesque Saguenay River route. It is the seat of a Roman Catholic bishopric and has a seminary, a normal school, and a hospital. Population (1951) 23,216.

CHIDAMBARAM, *chì-dũm'bá-rám*, town, India, in South Arcot District, southeast Madras Province, 23 miles south-southwest of Cuddalore and 125 miles south-southwest of the city of Madras. Rice and peanuts are processed here. Of numerous temples and pagodas, some of which date back to the 10th century, a temple to Siva is most important, drawing thousands of pilgrims to the town annually. Pop. (1941) 26,212.

CHIEF JUSTICE, the title of the presiding justice of the Supreme Court of the United States, and of the presiding justice of the several state supreme courts. Various other courts in the United States are also presided over by a chief justice. The chief justice of the United States is the highest judicial officer of the republic. Among his functions are those of administering the oath of office to the president and vice president at their inauguration, and of presiding over the Senate when that body is resolved into a high court for the trial of impeachments. In official dignity, he ranks next after the president.

Chief justices of the United States have been:

John Jay, of New York, nominated by George Washington, Sept. 26, 1789; resigned 1795.

John Rutledge, of South Carolina, nominated by George Washington, 1795; presided summer term, rejected by Senate, December 1795.

Oliver Ellsworth, of Connecticut, nominated by George Washington, 1796; confirmed March 4, 1796; resigned 1799.

John Marshall, of Virginia, nominated by John Adams, Jan. 20, 1801; confirmed Jan. 27, 1801; died July 6, 1835.

Roger Brooke Taney, of Maryland, nominated by Andrew Jackson, Dec. 28, 1835; confirmed March 15, 1836; died Oct. 12, 1864.

Salmon Portland Chase, of Ohio, nominated by Abraham Lincoln, Dec. 6, 1864; confirmed immediately; died May 7, 1873.

Morrison Remick Waite, of Ohio, nominated by Ulysses S. Grant, Jan. 19, 1874; confirmed Jan. 21, 1874; died March 23, 1888.

Melville Weston Fuller, of Illinois, nominated by Grover Cleveland, April 30, 1888; confirmed July 20, 1888; died July 4, 1910.

Edward Douglass White, of Louisiana, nominated by William Howard Taft, Dec. 10, 1910; confirmed Dec. 12, 1910; died May 19, 1921.

William Howard Taft, of Connecticut, nominated by Warren G. Harding, June 30, 1921; confirmed the same day; resigned Feb. 3, 1930.

Charles Evans Hughes, of New York, nominated by Herbert C. Hoover, Feb. 3, 1930; confirmed Feb. 14, 1930; resigned July 1, 1941.

Harlan Fiske Stone, of New York, nominated by Franklin D. Roosevelt, June 12, 1941; confirmed June 27, 1941; died April 22, 1946.

Frederick Moore Vinson, of Kentucky, nominated by Harry S. Truman, June 6, 1946; confirmed June 20, 1946; died Sept. 8, 1953.

Earl Warren, of California, nominated by Dwight D. Eisenhower, Sept. 30, 1953; presided at session opening Oct. 5, 1953; confirmed March 1, 1954.

CHIEM, Lake, *kēm* (Ger. *CHIEMSEE*, *kēm'-zā*), the largest lake in Bavaria, Germany. It lies about 40 miles east-southeast of Munich and about 30 miles west of Salzburg, Austria, covers an area of 32 square miles, and is 1,600 feet above sea level. It is drained by the Alz, a tributary of the Inn River. There are three islands in the lake: Herreninsel, containing a castle; Fraueninsel, the largest, containing a cloister and a fishing village; and Krautinsel.

CH'ÏEN LUNG, *chê-ên' lōōng'* or **KIEN LUNG** (dynastic name *KAO TSUNG*), Chinese emperor: b. Peking, Sept. 25, 1711; d. there Feb. 7, 1799. He was the fourth emperor of the Ch'ing (Manchu) dynasty, succeeding his father, Yung Chêng, in 1736, and reigning until 1796, when he abdicated in favor of his son, Chia Ch'ing. Under him China reached its greatest territorial limits, control over Tibet being established in 1751 and subjugation of the western areas which later became Sinkiang Province being accomplished between 1755 and 1760. Ch'ien Lung successfully resisted the efforts of European powers to expand relations with China, but in 1784 he allowed the United States to join other countries already trading at Canton.

His interest in literature was partly motivated by a desire to have unfavorable references to the Manchus expunged from all Chinese works. He authorized the compilation of three great collections of literature: a collection of histories (1739-1746); the Imperial Manuscript Library, a catalogue with critical comments on 3,462 works (1772-1781); and a 92-volume catalogue discussing 6,734 works not included in the library (1789).

CHIERI, *kyà'rè*, commune, Italy, in Torino Province, Piedmont Region, eight miles southeast of Turin. It is a textile manufacturing city. The largest Gothic church in Piedmont is here, and

the old walls still stand around the city. In the 11th century it was an independent republic. Pop. (1951) 14,788.

CHIETI, kyá'tè, (ancient TEATE) ; commune, Italy, capital of province of same name, on a hill near the right bank of the Pescara River, 93 miles east-northeast of Rome. It was anciently one of the largest and most important towns in this part of Italy, and was for some centuries in possession of the Greeks, from whom it passed successively to the Romans, Lombards, Franks, and Normans. In 1802 it was taken by the French troops. The modern town is the see of an archbishop and the seat of a superior civil and criminal court, and has manufactures of woolens, textiles, and a trade in silk, wine, wheat, and oil. Pop. (1951) 40,688.

CHIFFCHAFF, chíf'cháf, a small European bird (*Sylvia hippolaïs* or *Phylloscopus collybita*), of the warbler family (Sylviidae), so named from its cry. Its head, back and upper wings are ashy brown, and its under parts are brownish green dashed with yellow. In length it is between four and five inches, and it frequents woods, hedges and thickets. Its food consists of the larvae of various insects and some of the smaller moths.

CHIFLEY, Joseph Benedict, Australian political leader: b. Bathurst, New South Wales, Sept. 22, 1885; d. Canberra, June 13, 1951. After being educated at Patrician Brothers High School in Bathurst, he obtained employment with the New South Wales government railways, for which he became a locomotive engineer. Becoming an active member of the Federation of Locomotive Enginemen's Union, he became interested in labor politics and privately took up the study of economics, finance, and industrial law, eventually representing his union and the Locomen's Association before the nation's industrial arbitration courts. In 1928 he was elected a Labour Party member of the federal House of Representatives from the Macquarie constituency of New South Wales, and the following year he was appointed to serve as minister of defense in the Labour Cabinet. Although he lost his parliamentary seat in the general election of 1931, he was called on by non-labour administrations to serve in 1935-1936 on the Royal Commission on Monetary and Banking Systems, in 1939 on the Capital Issues Advisory Board, and in 1940 as director of labor supply and regulation for New South Wales.

In the 1940 general election Macquarie returned him to the House of Representatives, and in October 1941 Labour Prime Minister John Curtin (q.v.) appointed him commonwealth treasurer. During the succeeding war years, Chifley introduced a comprehensive system of wartime financial controls, planning and carrying through the greatest war loans in Australia's history, as well as tax increases, to meet wartime financial demands. From 1942 to 1945 he additionally assumed the new post of minister for post-war reconstruction, which he retained until February 1945. During the illness of John Curtin he was acting prime minister from April 30, 1945, and on July 4, following Curtin's death, he assumed the premiership, at the same time retaining his treasury post. At the general election of September 1946, when the Labour Party was again returned to power, Chifley continued as

prime minister. In the 1949 elections, however, his government was defeated when the Liberal Party successfully campaigned on the issue of a return to the free enterprise system and an end to socialism, and formed a coalition government under Robert G. Menzies. Chifley again led his party in the elections of April 1951, but was defeated for a second time by the Menzies' coalition.

CHIGGER. See JIGGER; SARCOPSYLLA.

CHIGI, ké'jè, a noble Italian family, founded by AGOSTINO CHIGI (1465?-1520) of Siena. He became a patron of the fine arts and banker for the pope. Peruzzi built for him the well-known Villa Farnese. Raphael painted there the *Triumph of Galatea* and *The Legend of Psyche*. Sodoma ornamented it with his fresco *The History of Alexander and Roxanna*. Consult Cugnino's *Agostino Chigi il Magnifico*. The family was further distinguished by five cardinals and one pope, Fabio Chigi (1599-1667), afterward Alexander VII (q.v.). FLAVIO CHIGI: (1810-1885), was one of the papal guard until 1848, when he was made bishop of Mira in *partibus*, nuncio at Munich, but was sent to Paris (1873) and later in the same year was made cardinal.

CHIGNECTO BAY, shíg-nék'tò, Canada, an inlet at the head of the Bay of Fundy, separating Nova Scotia from New Brunswick. It is 30 miles long and 8 broad, and has an isthmus of only 12 miles in width between it and Northumberland Strait, in the Gulf of Saint Lawrence. In 1888 work was begun on the construction of a ship railway across the neck of land connecting Nova Scotia with the mainland of Canada. The railway, 18 miles long, by uniting the Gulf of Saint Lawrence with the Bay of Fundy and the waters of the Atlantic Ocean, saves a run of several hundred miles around the province. The bay is noted for its high tides (to 50 feet).

CHIGNON, shên-yôn, (Fr. *chignon*, the nape of the neck), a peculiar arrangement of the hair, worn by women, a knot or mass, natural or artificial, arranged low on the back of the head, at the nape of the neck. This style of hairdressing was common in the 18th century, but fell into disuse. It was revived in the last half of the 19th century, again discontinued, and again revived in 1931, 1945, and 1951.

CHIGO, ché'gò. See JIGGER; SARCOPSYLLA.

CHIHUAHUA, ché-wā'wā, largest state of the Mexican Republic, bounded on the north by the United States (New Mexico and Texas). The northeastern section comprises a rolling, arid plain of great extent, which rises gradually from the Rio Grande (or Bravo) toward the foothills of the Sierra Madre Occidental which traverses the southwestern section of the state from northwest to southeast. Near the Coahuila border, in the southeast, is the Bolsón de Mapimí, a remarkable arid depression which, with irrigation, has great agricultural possibilities. Rainfall is limited throughout the state, except during the months from July to September, and agriculture is generally successful only where land can be irrigated. Because of this, cattle raising and mining are the principal activities, and population is sparse. A large lake (To-

ronto) has been created for irrigation purposes by damming the Conchos southwest of Camargo. Cotton, wheat, corn, and fruits of the temperate zone are grown to some degree. One of the principal agricultural products is a cheese which is known all over Mexico. The mountain areas of the southwest, in which most of the mineral wealth is located, are also rich in cedar and birch, and support an active lumbering industry, including the extraction of resin and turpentine. Several rivers have their headwaters in this section; some, like the Conchos, flowing east and north to the Río Grande, others, like those of the Yaquí and Fuerte systems, flowing west to the Gulf of California. Silver has been mined in Chihuahua on an extensive scale since 1544, some of the oldest and most productive silver mines in Mexico, notably the Parral (Parral Hidalgo) and the Santa Bárbara in the south, being in the state. Other minerals which are mined include lead, zinc, copper, mercury, gold, and coal.

Historically, the state is noted for its loyalty to Benito Pablo Juárez, president from 1861-1867, and for its savage fighters during the internal struggles after 1910. Following a raid on Columbus, New Mexico, by followers of Francisco Villa in 1916, the state was invaded by United States troops under Gen. John Pershing in an unsuccessful attempt to capture Villa. The state is well served by railways and roads, the principal ones running from the border cities of El Paso, Texas, and Ciudad Juárez to the capital city of Chihuahua in the center of the state, and south to Durango. There is also a railway which turns west from Ciudad Juárez to rejoin the main line at the capital, and a rail and road link with Ojinaga, another border town. The land area of the state is 94,822 square miles; pop. (1940) 613,696.

CHIHUAHUA, Mexico, capital of the State of Chihuahua, located at an altitude of some 4,600 feet in a rich livestock and mining district on the main highway and railroad line running between Mexico City and El Paso, Texas. Although the city contains many fine colonial buildings, it is essentially modern and international in character, having closer material links with the United States than with the more southerly parts of Mexico. The climate is warm in mid-summer, but moderate during the rest of the year. The town is built on the site of an Indian town which was conquered by the Spaniards, and was founded by Diego de Ibarra in 1539. Further development was retarded until silver mining in the vicinity rose to unprecedented heights early in the 18th century. The fine colonial buildings of the town, notably the profusely ornamented cathedral (built 1717-1789), date from this period. In 1811, Miguel Hidalgo y Costilla, the pioneer of Mexican independence from Spain, after a series of disastrous defeats which had followed an initial period of success during which he nearly reached the gates of Mexico City, was retreating northward when he was captured and taken to Chihuahua. He was here imprisoned and later shot by agents of the Spanish royal government. There is a fine monument to him in the Jardín Hidalgo. For a brief period in 1864, Chihuahua was the provisional capital of the Benito Pablo Juárez government during its struggle against Maximilian and the French intervention. The prin-

cipal industrial establishments are smelters and foundries, flour and cottonseed mills, soap factories, and breweries. Pop. (1940) 56,805.

CHILAN BALAM, chē-lān' bā-lām', *The Books of*, a series of writings in the Maya language, set down in the modified Latin alphabet introduced by the Spanish conquerors of Yucatán, probably soon after the conquest. Certain portions, however, date from as late as the early 17th century. *Chilan*, according to Diego de Landa, bishop of Yucatán from 1572 to 1579, was a term for a Maya priest whose functions were also those of medicine man and prophet, while *balam* means *tiger*, a symbol of this priestly caste. The various books making up the series are named for the village in which each was composed, and apparently are in part copies of older, hieroglyphic manuscripts which were secretly preserved from the general destruction of native writings which accompanied the conquest, and in part the rendering of stories and lore preserved orally, but they nevertheless contain many obvious interpolations of the Christian tradition absorbed by the scribes. Their contents are (1) prophecy and astrology, both showing evidence of European influence, and in a few cases clearly Christian teachings; (2) medical practice (diagnosis and preparation of remedies), showing European influence in some instances; and (3) a history of events from the settlement of Mayapán (1st century A.D.?) to the conquest. The history, unfortunately, is joined to a chronology which seldom gives the actual dates of happenings, but rather dates arbitrarily assigned for magical reasons. The books were first published in the United States by Daniel Garrison Brinton as *The Maya Chronicles* (Philadelphia 1882).

CHILBLAIN, chil'blān, or **FROSTBITE**, a mild or severe inflammatory reaction from the effects of severe cold on the toes, fingers, nose, chin, or ears. In mild cases there is swelling only, with an inflammation of the skin. This disappears and the part is apt to be tender. In severe frostbite there is ulceration and sloughing of the part. The treatment of mild chilblain is by slow raising of the temperature of the chilled part to that of the body. Too rapid heating results disastrously.

CHILCOTT, chil'kōt, **Ellery Channing**, American agriculturist: b. East Hamburg, N. Y., April 8, 1859. d. Ann Arbor, Mich., Nov. 14, 1930. He was educated in the common schools and at the Friends' Institute of East Hamburg. From 1882 to 1892 he was owner and manager of a stock ranch in Campbell County, S. D., and at the same time acted as United States deputy surveyor. He was elected to the state Senate in 1892, was professor of agriculture 1892-1897, professor of geology and agronomy and vice director 1897-1905 of the South Dakota Agricultural College. From 1893 to 1905 he was agriculturist of the United States Experiment Station, South Dakota. He wrote *The Relations between Precipitation and Crop Yields in the Great Pl.* (1927).

CHILD, Francis James, American scholar and educator: b. Boston, Mass., Feb. 1, 1825; d. Cambridge, Sept. 11, 1896. He was Boylston professor of rhetoric and oratory at Harvard from 1851 until 1876, when he exchanged for th

chair of English literature, which he held until his death. Child was an authority on Geoffrey Chaucer and John Gower. His principal work was the monumental *English and Scottish Popular Ballads* (5 vols., 1883-1898), an enlargement of his *English and Scottish Ballads* (8 vols., 1857-1858). He also edited *Four Old Plays—Three Interludes: Thersytes, Jack Jugler, and Heywood's Pardoner and Frere: and Jocasta, a Tragedy by Gascoigne and Kinwelmarsh* (1848); and *Poetical Works of Edmund Spenser* (1855).

CHILD, Sir Josiah, English merchant and economist: b. London, 1630; d. June 22, 1699. He acquired a large fortune in Portsmouth as supplier to the navy and invested much of it in the East India Company. He served as director of the company from 1677 and was its governor from 1681 to 1683 and from 1686 to 1688. Child wrote several papers in defense of trade with the East, arguing, in opposition to those who deplored the drain of gold, that the India trade passed through other countries with which Britain traded and thus returned indirectly a surplus in cash. He is best known for his *Brief Observations Concerning Trade and the Interest of Money* (1668), of which an enlarged edition was published in 1690, entitled *A New Discourse on Trade*. It was written in defense of the reduction, by legal enactment, of the rate of interest from 8 to 6 per cent, and recommended a further reduction, to 4 per cent. It also advocated the compulsory emigration of paupers to the colonies. Child served in Parliament in 1659, 1673-1678, and 1685-1687. He became a baronet in 1678.

CHILD, Lydia Maria (nee FRANCIS), American abolitionist and author: b. Medford, Mass., Feb. 11, 1802; d. Wayland, Mass. Oct. 20, 1880. Her first novel, *Hobomok*, was published in 1824, and from then until her death she continued her literary activity. From 1826 to 1834 she edited the *Juvenile Miscellany*, the first children's periodical of literary merit published in the United States. In 1828 she married David Lee Child, a Boston lawyer. The Childs became ardent abolitionists, and Mrs. Child published one of the first antislavery books, *An Appeal in Favor of That Class of Americans Called Africans* (1833), which aroused much opposition and cost her her literary popularity in the South. From 1841 to 1849 she edited the *National Anti-Slavery Standard*, her husband serving as coeditor in 1843-1844. Her numerous works include *The First Settlers of New England* (1829); *Philothea* (1836); *Fact and Fiction* (1846); *Isaac T. Hopper* (1853); *Progress of Religious Ideas Through Successive Ages* (3 vols., 1855); and *A Romance of the Republic* (1867).

CHILD LABOR. The term "child labor" is defined by the United States Department of Labor as the employment of boys and girls when they are too young to work for hire, or when they are employed at jobs unsuitable or unsafe for children of their ages or under conditions injurious to their welfare. It is any employment that robs children of their rightful heritage of chance for healthful development, full educational opportunities, and necessary playtime. The term has had different meanings at various times and in various communities, depending on society's concept of its responsibility for its

youth. This concept has steadily broadened in scope as knowledge of the needs of children and young people has expanded, as awareness of the necessity for an educated citizenry in a democracy has increased, and as labor standards in general have risen to higher levels.

Legal Regulation.—The movement for legal regulation of child labor began in England at the end of the 18th century, when the introduction of the factory system led to the exploitation of young children. In the United States initial efforts to control child labor were designed to combat conditions that a few decades later would seem almost incredible. At the beginning of the 20th century children 8 and 10 years of age still tended cotton looms, and boys only a little older stood all night before the glory holes of glass factories and worked as breaker and mule boys in coal mines. By the 1950's the worst abuses of child labor in the United States had been curbed by state and federal legislation and by an enlightened public opinion. The modern attitude in respect to child labor was foreshadowed by the Children's Charter of the White House Conference on Child Health and Protection (1930), which stated:

"For every child protection against labor that stunts growth, either physical or mental, that limits education, that deprives children of the right of comradeship, of play, and of joy. . . ."

More specifically, the Midcentury White House Conference on Children and Youth (1950) adopted the following recommendation:

"That states and other appropriate public bodies establish and enforce standards covering the employment of youth in all occupations, such standards to include minimum age and wages, as well as hours of work, night work, protection from hazardous occupations, and provisions for workmen's compensation. . . ."

Federal Legislation.—One great step forward in achieving these standards was taken through the child labor provisions of the Fair Labor Standards Act of 1938 and its 1949 amendments (effective Jan. 25, 1950), which prohibit (1) the shipment in interstate or foreign commerce of goods produced in establishments where oppressive child labor has been employed within 30 days prior to removal of the goods; and (2) the employment of oppressive child labor in interstate or foreign commerce or in the production of goods for such commerce. Oppressive child labor is defined as employment of minors under 16 years of age in any occupation covered by the act and employment of minors between 16 and 18 in occupations declared hazardous by the secretary of labor. Children between 14 and 16 may be employed outside of school hours in a limited number of occupations under regulations issued by the secretary of labor, where such employment has been determined not to interfere with their schooling or health and well-being. Exempted from these provisions are children employed by their parents in occupations other than manufacturing or mining and other occupations designated as hazardous. Also exempted are children employed in agriculture outside of school hours, and those employed as actors in theatrical, motion picture, radio, and television productions, and in the delivery of newspapers to consumers. As of 1952, work in the following occupations had been declared hazardous and thus closed to minors under 18: (1) explosives manufacturing; (2) motor vehicle driving and helping; (3) coal

mining; (4) logging and sawmilling, with specified exceptions; (5) working with power-driven woodworking machines; (6) work involving exposure to radioactive substances; (7) working with power-driven hoisting apparatus, including elevators; (8) working with specified power-driven metalworking machines; (9) mining other than coal mining, with specified exceptions; and (10) slaughtering and meat packing or rendering.

Two other federal laws contain child labor provisions. The Public Contracts (Walsh-Healey) Act of 1936 requires that any contractor manufacturing or furnishing goods or supplies for the federal government in an amount exceeding \$10,000 will not employ boys under 16 or girls under 18 on such work. The Sugar Act of 1948, which succeeded the 1937 act, stipulates that to qualify for benefit payments growers of sugar beets and sugarcane must not employ children under 14, or children 14 to 16 for more than 8 hours a day.

Prior to the enactment of these laws, three unsuccessful attempts had been made to control child labor by federal legislation. The Child Labor Act of 1916, the result of 10 years of effort, forbade the shipment in interstate and foreign commerce of goods produced in specified industries where children were employed in violation of specified age and hour standards. This law became effective on Sept. 1, 1917. Nine months later, on June 3, 1918, it was declared unconstitutional on the ground that Congress had exceeded its constitutional power to regulate interstate commerce (*Hammer v. Dagenhart*). The second attempt, the child labor clauses of the Revenue Act of 1919, provided for the levying of a tax of 10 per cent on the net profits of specified industries employing child labor. This act, which became effective in April 1919, was declared unconstitutional on May 15, 1922, on the ground that Congress, under the guise of a tax which on the face of the act was a penalty, could not regulate a matter within the reserved rights of the states (*Bailey v. Drexel Furniture Co.*). Control of child labor through the codes of fair competition established under the National Industrial Recovery Act of 1933 was likewise short-lived. Almost all the codes contained a basic 16-year minimum age provision for all employment, and about three fourths of them set a minimum age of 18 for occupations especially hazardous or detrimental to health. The entire act was declared unconstitutional on May 27, 1935, on the ground that it attempted to regulate intrastate transactions outside the authority of Congress and was an unconstitutional delegation of legislative power (*Schechter Poultry Corp. v. United States*), but industry's acceptance of the 16-year minimum age standard undoubtedly prepared the ground for public support of this standard in the Fair Labor Standards Act of 1938.

The decisions that the child labor laws of 1916 and 1919 were unconstitutional showed the need for a constitutional amendment definitely giving Congress the power to enact child labor legislation, and led to strong agitation for such action. In June 1924, the 68th Congress adopted a joint resolution for an amendment giving it the power to limit, regulate, and prohibit the labor of persons under 18, and stipulating that the power of the states should not be impaired. Efforts to secure ratification of the amendment

by the required three fourths of the states arouse much opposition, and by 1937 only 28 states had ratified it. Endeavors to obtain the remaining 8 ratifications needed for adoption lapsed after February 1941, when the Supreme Court held that all the restrictions of the Fair Labor Standards Act, including those on child labor, were constitutional (*United States v. Darby Lumber Co.*). The court specifically overruled the decision which had declared the first federal child labor law unconstitutional. The 1941 decision settled the issue of constitutionality and removed the immediate necessity for ratifications of the amendment.

State Legislation.—Child labor is regulated by state governments as well as by the federal government. The first state law establishing a minimum age was enacted by Pennsylvania in 1848. It prohibited the employment of children under 12 years of age in textile mills. Child labor laws were also in effect in a number of other states many years before the enactment of federal legislation.

An employer must obey both state and federal laws affecting child labor; if they differ, he must follow the higher standard. State laws vary considerably as to occupations covered and standards set up for the employment of children and young people. Some laws apply to all gainful occupations, others exempt agriculture or domestic service, and still others apply only to specified establishments. Standards for state child labor laws recommended by the National Conference on Labor Legislation include:

(1) *Minimum age:* 16 for factory employment and any employment during school hours; 14 for nonfactory employment outside of school hours.

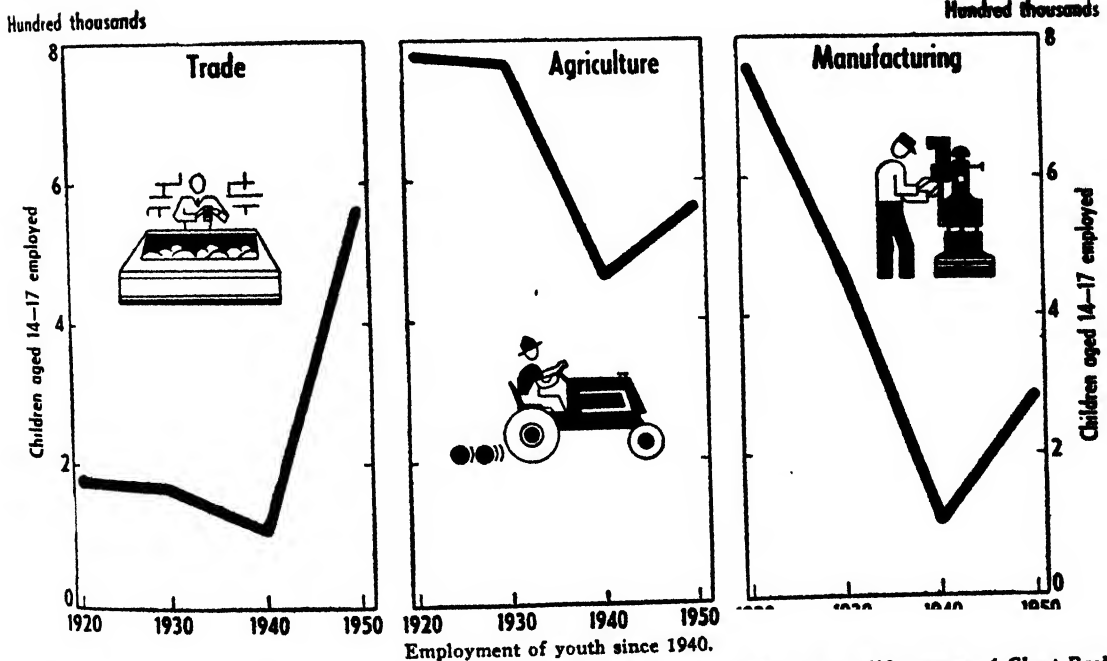
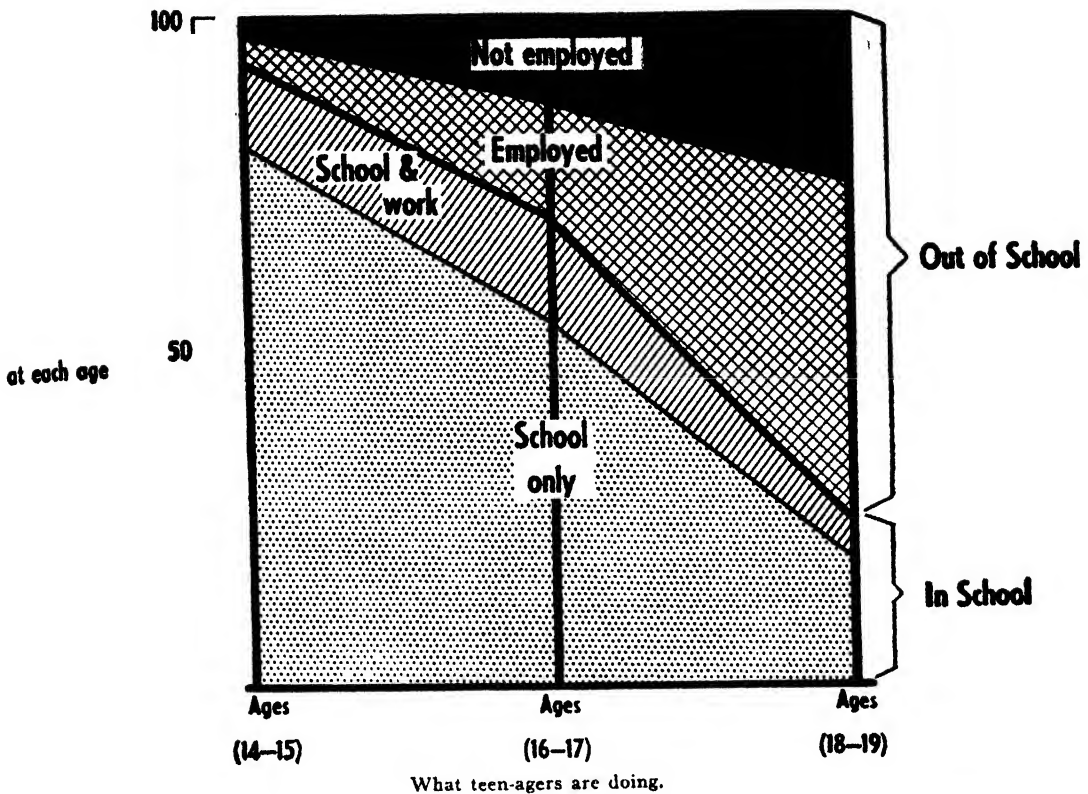
(2) *Hazardous occupations:* minimum age of 18 in a considerable number of hazardous occupations; state administrative agency authorized to determine such occupations.

(3) *Maximum daily and weekly hours:* 8-hour day and 40-hour week for minors under 18.

(4) *Night work during specified hours:* 12 hours of night work prohibited for minors between 16 and 18.

(5) *Employment certificates:* required for all minors under 18.

Although there has been steady progress in meeting these standards, none of them is met by all the states. As of 1951, the laws of 23 states, Alaska, and Puerto Rico set a basic minimum age of 16 for general employment; in 2 states, the age was 15; in 22 states, the District of Columbia, and Hawaii, 14. One state, while not setting a minimum age, did not permit employment of children required to attend school. For children under 16, the 8-hour day had been adopted in all but 5 states, and night work was prohibited for 12 hours or more in more than half the states. For minors 16 and 17 years of age, 15 states had set an 8-hour day, and 7 others had this standard for girls only. The 40-hour week was the standard in 5 states, Alaska, and Puerto Rico for those 16 and 17 years old. Most of the other states set a maximum 48-hour week for this age group. Employment or age certificates were required in 43 states, the District of Columbia, Alaska, Puerto Rico, and Hawaii for children under 16; and in 22 states, the District of Columbia, Puerto Rico, and Hawaii for minors 16 and 17 years of age. In the remaining states certificates were issued upon request.



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Child Labor in Emergency Periods.—In the 1940's, when defense and war production created manpower shortages, there was a trend toward relaxing state child labor laws to meet the strong demand for young workers. Offsetting this trend was the policy of upholding child labor standards, adhered to by federal agencies, including

those concerned with manpower requirements, and by organized labor. Also effective was the work of woman's groups and other private organizations in defeating many bills designed to lower these standards. In 1942, the Children's Bureau organized the National Commission on Children in Wartime, which adopted the Chil-

dren's Charter in Wartime, emphasizing the danger of relaxing child labor standards. Nevertheless, employment (full and part time) of children 14 through 17 years of age increased from 875,000 to more than 3,000,000 during World War II. Thousands of young people dropped out of school; other thousands attended school and worked a 6- to 8-hour shift after school hours. The worst abuses during the war resulted not from relaxation of legal regulations but from low standards and exemptions in state laws, and from the inability of enforcement agencies to cope with illegal employment.

The national emergency and increased industrial production after the outbreak of the Korean War in 1950 created a situation similar to that during World War II, emphasizing the need for strengthening state laws and enforcement machinery. According to the United States Bureau of the Census, the number of employed minors (in both full- and part-time employment) in the age group from 14 to 17 increased from 2,071,000 in October 1949 to 2,469,000 in October 1950, but decreased to 2,344,000 by the same month in 1951 because of the decline in the employment of those 14 and 15 years of age. The totals are broken down as follows:

	Age group 14-15	Age group 16-17
October 1949	701,000	1,370,000
October 1950	916,000	1,553,000
October 1951	762,000	1,582,000

Although the Bureau of the Census does not customarily enumerate the number of employed children under 14 years of age, it made two sample surveys for the Department of Labor in 1950. These revealed a large number of children 10 through 13 years of age at work in agriculture, as newspaper carriers and sellers, as baby sitters, and in stores. In August 1950, an estimated 1,094,000 children (one eighth of the total population in this age group) were at work; in October, a school month, 719,000 (one twelfth of the total age group) were at work.

International Movements for Regulation.—

The International Association for Labour Legislation, established in 1900 with headquarters in Basel, Switzerland, was the first organization to focus attention on the international aspects of labor legislation, including that on child labor. A conference held at Bern, Switzerland, in 1913 recommended prohibition of night work for children under 16, but it took no action on minimum age in general. Largely as a result of the pioneering work of the association, the International Labour Organization (ILO) was established in Geneva in 1919 by the Treaty of Versailles. First an independent agency and later an autonomous associate of the League of Nations, the ILO is now a specialized agency of the United Nations. Article 41 of its constitution states that one of its guiding principles is "the abolition of child labour and the imposition of such limitations on the labour of young persons as shall permit the continuation of their education and assure their proper physical development."

The general conference of the ILO meets yearly and adopts draft conventions which are submitted to the member nations for ratification. The first conference, held in Washington, D.C., in 1919, adopted draft conventions setting a minimum age of 14 for employment in industry (with exceptions for Japan and India) and a minimum age of 18 for night work between 10 P.M. and 5 A.M. (with some exceptions). The second con-

ference, held in Genoa, Italy, in 1920, adopted a draft convention setting a minimum age of 14 for employment at sea. Conventions adopted in later years raised the standards and widened the scope of recommended child labor legislation. As of 1951, they provided for a 15-year minimum age in industrial and nonindustrial employment and on the high seas, with a higher age for trimmers and stokers on vessels, and a 14-year minimum age in agriculture. In addition, they prohibited a 12-hour period of night work for minors under 18 in both industrial and nonindustrial employment.

The 1945 conference of the ILO, held in Paris, France, adopted resolutions setting forth a full program for the protection of children and young workers. It held that governments "... should accept responsibility for assuring the health, welfare, and education of all children and young persons and the protection of all youthful workers of either sex, regardless of race, creed, colour, or family circumstances, both by national action and by appropriate measures of international cooperation," and that "... questions relating to the health, education, employment, protection and general welfare of children and young persons are interrelated and cannot be solved in isolation."

See also FEDERAL WAGE AND HOUR LAW, THE; LABOR LEGISLATION.—*Child Labor*. For child labor in other countries, and the laws concerning it, see LABOR LEGISLATION, FOREIGN; CANADA.—*Labor—Labor Legislation*; GREAT BRITAIN.—*Education—Inception of National System*.

Bibliography.—National Child Labor Committee, publications (New York 1905—); Clopper, E. N., *Child Labor in City Streets* (New York 1912); Fuller, R. G., *Child Labor and the Constitution* (New York 1923); Lumpkin, K. D., and Douglas, D. S., *Child Workers in America* (New York 1937); Abbott, Grace, *The Child and the State*, 2 vols. (Chicago 1938); McWilliams, Carey, *Factories in the Field* (Boston 1939); International Labour Organization, *Protection of Children and Young Workers* (Montreal 1946); U.S. Bureau of Labor Standards, publications (Washington 1946—); U.S. Children's Bureau, publications (Washington 1920–1946); *Monthly Labor Review*, articles on child labor (Washington, monthly).

CHILD PSYCHOLOGY. Psychology by simple definition is the science of the mind. Mind is a comprehensive term which includes not only intelligence and thinking, but also sensations, perceptions, feelings, concepts, attitudes, and actions. Psychology as a science attempts to describe and to interpret the operations of the mind as made evident in observable behavior and recordable reactions. Child psychology is particularly concerned with the early organization of human personality—with the beginnings, the trends, and the patterns of mental development prior to the teens. The psychology of adolescent and adult is naturally continuous with that of the child.

The Cycle of Child Development.—What are the beginnings of the human mind? Birth marks the arrival but not the true commencement of an individual. The life career of the individual begins with conception, when the genes of father and mother unite and initiate a cycle of growth. A minute globule of protoplasm becomes an embryo, the embryo becomes a fetus, the fetus an infant, the infant a child, the child a youth, the youth an adult, the adult a parent. With parenthood another cycle of growth is liberated.

The genes initiate the mental as well as the physical products of growth. From the earliest

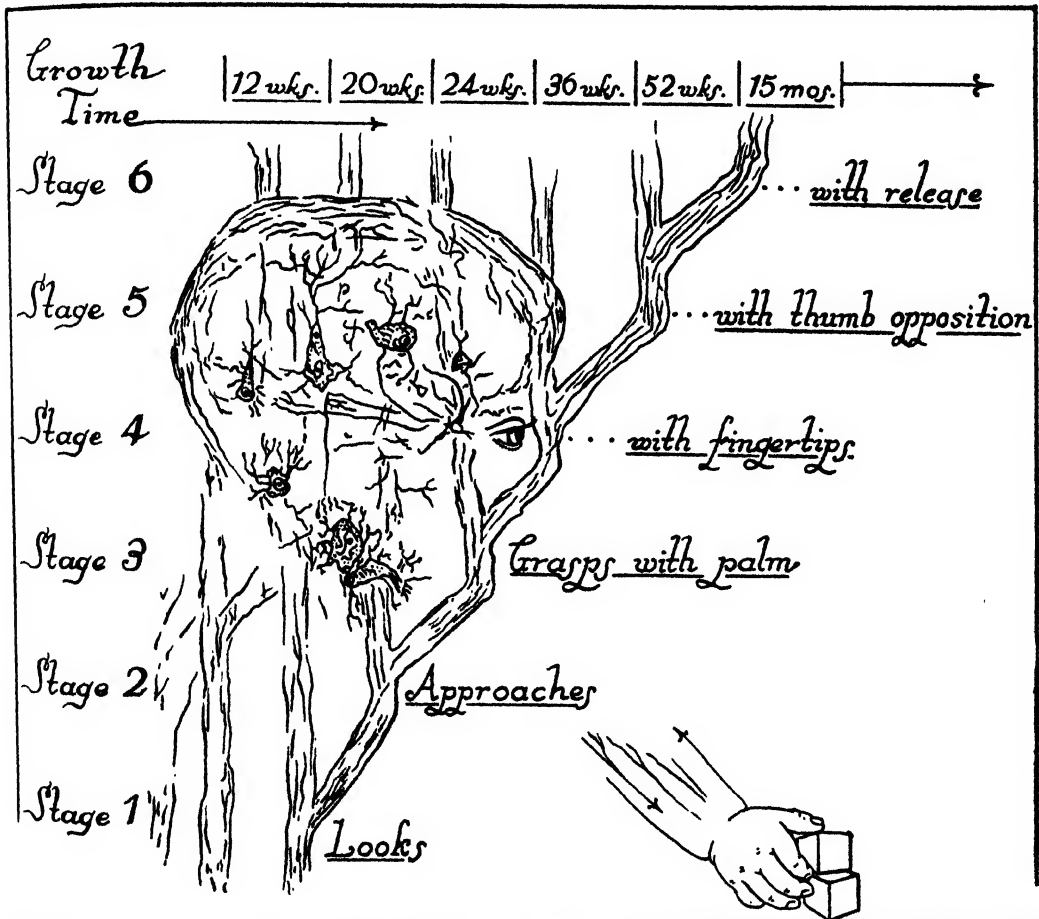
his body, "of growth. Growth, therefore, is the key concept for understanding the nature and the needs of the child mind.

The mind does not have a fixed separate existence within a bodily dwelling. It is part and parcel of an indivisible growing organism, responsive to the joint influence of the genes and of the environment. The mind cannot be regarded as pure energy, for it is a patterned and a patterning system. Indeed, the mind of the child is a living, growing action system. Our task in this brief article will be to trace the growth of that action system in the first ten years of life.

It takes a long time for a child to grow up. Physical maturity (and, in large measure, also psychological maturity) is reached at about the age of 20 to 24 years. This long period of

"infancy" (as the biologist uses the term) is the period during which the individual achieves his racial inheritance. Infancy was evolved and prolonged to meet the needs both of racial inheritance and of individual learning.

The cycle of growth which begins with conception is therefore extremely complex. The human organism to some extent has to retrace previous stages of evolution. Accordingly, fetus and infant display physical and behavior traits which are reminiscent of primitive phases of the history of the race. But there is no evidence that the human individual ever fully reduplicates or rehearses early phyletic stages. The human infant from the beginning is human in make-up and in potentialities. Similarities between human and infrahuman behavior can be misleading, as emphasized by Madame Nadie Kohts who compared the behavior of a male chimpanzee during the age period from one and one-half to four years with that of her son from birth to



From *The Child from Five to Ten* by Arnold Gesell and Frances L. Ilg. Copyright 1946 by Arnold Gesell and Frances L. Ilg. Used by permission of Harper & Brothers.

A symbolic diagram of the growth processes which underlie the patterning of behavior. Six stages in the development of prehensory behavior are pictured: 1. At 12 weeks the infant merely looks at the cube; 2. at 20 weeks he approaches it with a bent arm; 3. at 24 weeks he grasps it with a palmar squeeze; 4. at 36 weeks he grasps with his fingertips; 5. at 52 weeks with forefinger and thumb opposition; 6. at 15 months he both grasps and releases adaptively; placing one cube upon another. He builds the tower in a twink. The twink is based on 15 months of post-natal growth time.

These reactions are made possible by patterned connections between countless neurons and muscle fibers. The connections are symbolically represented by the outgrowths of variegated neurons in brain and spinal cord. Neurons sprout and grow not unlike plants and trees. They put forth branches, sub-branches, end-tufts, and terminal arborizations. Threadlike fibrils extend from fingertips to cord and to cortex. A million nerve fibers unite the eye to the vastly complex jungle of neurons in the cortex. This living, patterned and patterning tissue affords an intimation of how the mind grows.

four years of age. She sums up her observations as follows:

(1) In the functional biological field: the chimpanzee *... ignores* the possibility of walking erect and of free-*ing* his hands for carrying weights, (2) In the sphere of imitation: the chimpanzee is devoid of imitation insofar as human sounds are concerned and generally fails to extend or improve his imitative behavior, (3) In respect of emotional, altruistic and social behavior: the chimpanzee fails to understand the advantages of friendly sympathetic intercourse with creatures standing on a lower biological level than himself, (4) With respect to habit-forming: the chimpanzee does not improve in the motor habits connected with the use of tools and household implements, (5) In the sphere of playful behavior: he does not indulge in creative constructional play . . . It is impossible to say that he is "almost human"; we must go even further and state quite definitely that he is "by no means human."

The Beginnings of Mental Life.—The patterning of human behavior gets under way remarkably early. By four weeks after conception the heart beats. By eight weeks, muscles and nerves have so far advanced that the fetus may stir, making a few simple movements of the head and trunk. By 12 weeks, the fingers flex and eyes move beneath fused lids. By 24 weeks, the chest is capable of rudimentary rhythmic movements. By 28 weeks, physiologic and behavioral functions may be sufficiently mature to insure the survival of a prematurely born infant, under modern conditions of pediatric care. The premature infant, however, gains no permanent lead over the full-term infant because the sequences and patterns of behavior are fundamentally governed by the genes.

The newborn infant is in possession of some 12 billion nerve cells which constitute his brain and sensorimotor nerves. This is the full quota, all that he will ever have. As the infant grows and as the child grows, these cells become organized into patterns of responsiveness and of reaction. In this sense the nervous system is the organ and the instrument of the "mind," of conscious experience, and of the residuals and promptings of past experience, sometimes called the unconscious. The nervous system, however, is part and parcel of the unitary organism; it is influenced by the constituents and states of the blood and body juices, by hormones and electrochemical regulators.

It is idle to ask where body stops and where mind begins. The infant cannot introspect and tell us when he becomes "conscious." There may well be glimmers and even states of psychic being in prenatal and the early postnatal periods of activity, for mind and action are closely allied.

Note the various action patterns of the four-weeks-old full-term infant. He uses his eyes adaptively. Dangle an object and move it slowly across his field of vision: his eyes will follow a short distance in active pursuit. He cannot freely rotate his head; he prefers to lie with head to one side; often he extends the arm on that side, crooking the other arm at shoulder level in a kind of fencing attitude. This is the tonic-neck-reflex posture. He holds and activates this posture from time to time, as though it were a developmental exercise. This is nature's method of preparing for the coordination of eyes and hands. Behavior is patterning. This is a manifestation of mental life. This is how the mind grows.

Even social behavior seems to be in the making. The infant regards the face of his caretaker. At favorable moments he heeds the human voice by diminishing his bodily activity. Occasionally small throaty sounds as well as

cries emerge from his larynx. He tends to quiet when securely held.

Thus we see that the newborn infant already gives developmental tokens of the four major fields of human behavior: motor, adaptive, language, and personal-social. These four fields are intimately interrelated, and no single field develops by itself. Each influences the other and the mind grows as a unit. It will be convenient, however, to discuss the fields individually in accordance with the following outline:

(1) Motor behavior: posture and locomotion; prehension and manipulation; gross and fine motor coordinations.

(2) Adaptive behavior: self-initiated and induced behavior; learning; resourcefulness in adjusting to new situations; exploitive behavior; intelligence.

(3) Language behavior: vocalizations; vocal signs; words; gestures; comprehension.

(4) Personal-social behavior: reactions to persons; response to gesture and speech; socialized learning; habits of self help.

Motor Development.—All told, a child has over 600 distinguishable muscles. These muscles, both fine and gross, are supplied by an extremely complex network of nerve fibers and fibrils. The tiny muscles which move the eyes are elaborately connected with the higher nerve centers of the brain; likewise, the delicate muscles which activate the larynx and the fingers are richly represented in the cerebral cortex. If a child were completely paralyzed, mind, as we know it, would be completely wanting. Perceptions, memories, intentions, desires, imaginings, and acts all have a motor basis. For this reason the story of mental development must be built around the acquisition of motor abilities and motor experiences.

Motor development proceeds from head to foot. It takes a full year or more before the infant stands alone and walks erect. First he "learns" to erect his head and to keep it steady on his shoulders. This is not true learning because the capacity depends mainly on a ripening or maturation of the controlling nerve structures. In due course he gains, by similar maturation, control of his arms and his trunk. First he sits by leaning forward using his arms as outriggers; later he sits upright without support. In due course, he pulls himself to his feet, cruises along the rail of his crib, and finally toddles off by himself on two feet. Walking is preceded by over 20 stages of prone behavior, including the swimming posture in which the baby at about 16 weeks of age arches his back, lifts his head, and lifts his legs in symmetric extension; pivoting at about 28 weeks; backward crawl, with abdomen on the ground surface at about 30 weeks; creeping on hands and knees at 40 weeks. Many infants toward the end of the first year creep on all fours—that is, on hands and soles. Soon soles alone suffice, and this frees his hands for carrying weights. Indeed, the erect posture was apparently evolved to emancipate the eyes and hands, so they might be used for higher purposes.

The motor coordination of eyes and hands advances by steady stages throughout the first ten years of life and into adolescence. For some 12 weeks the normal infant prefers the tonic-neck-reflex posture already mentioned. This is an asymmetric posture which undergoes growth changes: it leads the baby to look in the direc-

tion of the outstretched arm, to notice the arm in motion, to gaze momentarily and prolongedly upon his hand. At about 16 weeks, the infant prefers to hold his head in midposition, and to close in bilaterally with both hands upon an object dangled above his chest. This is the beginning of prehension. At 24 weeks he begins to reach unilaterally. At 28 weeks, having grasped an object, he transfers it from hand to hand. Early grasp is crude and pawlike, but at 40 weeks it becomes more delicate: the infant can pluck a pellet with precise pincer prehension, bringing thumb and index finger into opposition. Near the close of the first year, he "learns" to release a grasped object voluntarily. This new power of inhibition, like his earlier abilities, requires the maturation of higher nerve centers. It brings his growing motor abilities under increasing voluntary control. He begins to manipulate objects in an exploitive manner. He exercises his new-found power of release by inserting an object into a container. This behavior pattern reflects increasing intelligence and reminds us again that the mind is a unit and that adaptive, intelligent behavior is dependent upon motor developments and experience.

Practice and favorable experience tend to perfect motor performances; but the basic motor skills are untaught; they arise out of inborn sequences of development. For similar reasons, the genes play a primary role in determining handedness, eyedness, and footedness. Many children are by nature strongly right-handed or strongly left-handed; others are somewhat neutral, and to that extent are subject to custom and training. Deep-seated left-handedness, hereditary in origin, tends to show itself in a well-defined leftward tonic-neck-reflex posture in early infancy. Similarly right-handedness is manifested in a rightward tonic-neck-reflex. Hand dominance often shows itself clearly by the age of 40 weeks in spontaneous play activities; but marked interchangeability with considerable use of both hands is common at one and one-half, two and one-half, and three and one-half years of age. Nature does not place a premium on ambidexterity; unidexterity with auxiliary cooperation by the subordinate member is the rule.

A series of examples will indicate how the progressive development of motor abilities depends upon maturity factors. The two-year-old child can run without falling, and usually can walk up and down stairs alone. At three years he can jump from the bottom stair; at four years he can skip on one foot; at five years he skips using one foot and then the other alternately. He tosses and bounces and catches a ball at six years. At seven years he begins to be interested in learning to bat and pitch. At eight years he participates willingly in folk dances if he feels the rhythms and motor patterns dramatically. At nine and ten years the child displays increased self-motivated interest in acquiring motor skills.

Although there is a basic ground plan of motor development characteristic of the species and of stocks within the species, there are important individual differences reflected in variants of the ground plan. Some children are more motor-minded than others. They sense reality in terms of movements, manipulations, and postural attitudes. Such children may be

"slow" in reading, but they have compensating abilities. Verbal children, in contrast, may be adept in reading, but may lack other motor excellences. The degree to which handicapped children can overcome their motor disabilities depends largely on the available neuromuscular equipment and on strength of motivation.

Adaptive Behavior.—When sensorimotor equipment is put to self-initiated and induced uses, behavior takes on an adaptive, intelligent character. When the young baby begins to use his eyes in an inquisitive manner, to inspect his surroundings, he shows that his mind is at work. Whether we call his behavior reflex, voluntary, self-directed, natural, or intelligent is indeed a matter of semantics. We do know that an infant at 16 weeks of age may exhibit a veritable visual hunger. He frets when this hunger goes unappeased. He quiets when ocular and social stimuli combine to feed his appetite for visual experience.

This is the very time when the process of growth makes new demands upon his capacities to see. He must perceptually differentiate between his own hand and the hand of his caretaker, and the object which is proffered or which he holds. He was born with eyes, and with the potential tendencies to make the foregoing distinctions. If his inheritance is normal, he exercises his capacities at the appropriate level of maturity. If he is poorly endowed, or if his neuromotor equipment has been damaged by injury, disease, or defective genes, he may not display adequate adaptive behavior, even in the most elementary use of his eyes and hands.

Vision leads in the early growth of mentality. The baby takes hold of the physical world with his eyes before he takes hold with his hands. The next step in the development of adaptive behavior is to bring eyes and hands into coordination. Soon he begins to reach on sight; and having seized the object of interest, he exploits it by mouthing it, banging it, and rubbing it with whatever maneuvers his motor equipment permits. Eyes and hands now act in near unison, each assisting the other; visual cues and touch cues interact. The eyes are teamed as a pair; the hands are teamed as a pair; and the eyes and hands together and in alternation are likewise teamed. By an intricate process of reciprocal interweaving, the action system builds up patterns and propensities of adaptive behavior.

These patterns show themselves in his spontaneous and imitative behavior. It is instructive to see how he uses his intelligence in playing with blocks. At 24 weeks of age a typical infant grasps and holds a one-inch wooden cube; he makes an approach upon a second cube placed on a table within easy reach. At 32 weeks he picks up a cube in each hand and holds the two cubes prolongedly. At 40 weeks he brings them together in a midplane, in a pat-a-cake manner. Incidentally, he does not "learn" to play pat-a-cake until this age. Even his ability to imitate a nursery game depends upon his maturity.

At one year he can release a cube into a cup. At 18 months he releases one cube upon another to build a tower of three cubes. At two years he aligns the three cubes in a horizontal row. At three years he arranges them into a bridge. At four years he builds a gateway with five cubes, and at five years, a staircase of six cubes.

These patterns of adaptive behavior follow

each other in a lawful sequence. There are individual differences, but the general order of development is determined by a maturational ground plan. For this reason it is futile to attempt to teach a child to build a bridge at 18 months, and to play pat-a-cake at six months.

Similar sequences govern the manipulation of objects less material than building blocks, namely, words, sentences, symbols, and ideas. Through its schools, the culture begins to teach words in a systematic manner when the child reaches the age of six years. But here, too, his ability to adapt to words depends upon his maturity as well as his learning. Reading readiness, therefore, shows significant variations based upon inborn individual differences as well as upon methods of instruction. A relatively "average" child at the age of four may begin to identify capital letters; at five he is interested in numbers on the clock dial; at six he shows interest in small as well as in capital letters; at seven he recognizes familiar words out of context, and reads sentences in context; at eight he may even use a table of contents and index; and at nine he can utilize a dictionary.

With the aid of vocabulary scales and Binet tests, it is possible to appraise a child's intelligence in terms of his command of the written, the spoken, and the printed word. But both from a biological and a cultural standpoint, it is important to recognize that some children who are backward in reading and slow in speech, nevertheless may be highly intelligent and gifted in other less measurable areas of adaptive behavior.

Language and Thought.—Although there is no one-to-one correlation between verbal facility and so-called intelligence, the developmental relationship between language and thought is fundamental. Speech and visual perception are two of the most distinctive behavior features of the human species. It is not surprising, therefore, that these two functions undergo a long and complex development.

The newborn infant communicates by cries. He develops a vocabulary of cryings and frettings, the several meanings of which a discerning mother learns to differentiate. At four weeks the infant makes small throaty sounds; at 12 weeks he chuckles; at 16 weeks he laughs aloud. By 28 weeks he has in his babbling articulated such a rich variety of consonants and polysyllabic vowels that he gives ample promise that he will form words under the impress of the culture into which he is born. He may even grow up in a bilingual home and come out with two languages. By 15 months he jargons more or less volubly, as though he were carrying on a conversation. Jargon with all its rhythms and inflections seems to be the growth rudiment of phrases and sentences. In another year, jargon is shed. Three-word sentences emerge, and language becomes a useful tool. It serves not only for communication, but also for self-control. For example, voluntary control of bowel and bladder often coincides with the ability to name the products or process of elimination.

At four years, language burgeons. Hence the almost universal pleasure in nonsense words and silly language and rhyming at this age. At five years, the child shows a new interest in the meanings of words and uses language conformingly, asking "Is this the way to do it?"

At six and seven years, words are often asso-

ciated with magic powers. The child does not easily and consistently distinguish between fact and fancy; but with the aid of words he engages in private and expressed thinking about natural phenomena, life, death, superman, etc. The eight-year-old may speak with almost adult fluency. He can verbalize ideas and problems. He differentiates more clearly between fact and fancy. By ten years his thinking is still more critical; he often reduces his thoughts to writing and to diagrams. Alas, even as an adult he continues to have difficulty in making his thinking realistic and may succumb to the deceptions and black magic which sometimes lurk in words.

Personal-Social Behavior.—From the moment of birth the human infant feels the impacts of personal care and ministrations. He is an individual, but he is not an encapsulated ego. He soon begins to sense the unremitting attention which he receives. He senses it through passive touch, through hearing, and above all, through vision. He soon displays an amazing ability to read with his eyes the facial expressions, the gestures, the postural attitudes, and thereby the emotional attitudes of all the persons with whom he comes in contact. Paradoxically, his own personal sense of self is built up through these other persons—parents, siblings, playmates, teachers. The make-up of his personality depends greatly upon interpersonal relationships which he experiences from day to day and from age to age.

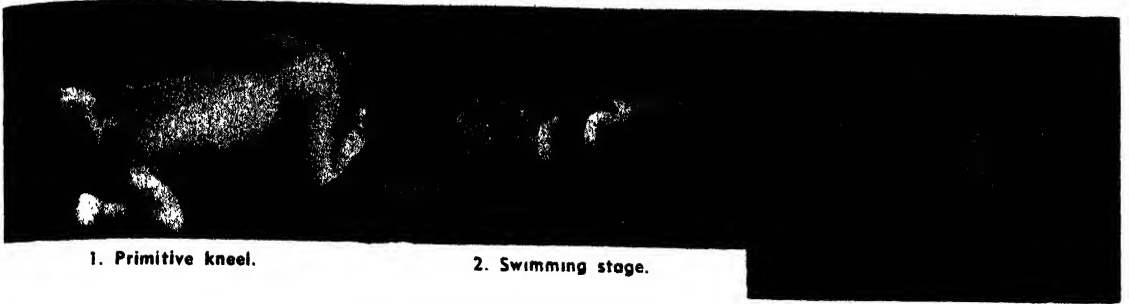
The child, however, is never completely made over by the culture. He retains a core of individuality, determined by the genes, by his stage of maturity, by intrinsic temperament, and by the inborn uniqueness of his particular pattern of growth. Nature, perhaps wisely, sets metes and bounds to his docility and amenabilities. At any rate, he must do his own growing, and he will regulate his personal-social behavior in terms of his insight and his capacity to profit by experience.

Social insight grows and patterns through a countless succession of interactions between the child and other persons. A one-year-old baby likes to repeat performances laughed at, thereby increasing both his own sense of self and his appreciation of others. Rolling a ball back and forth sets up a to-and-fro reciprocity with a partner. This illustrates a dynamism which operates throughout life in the organization of interpersonal relationships.

The problems of the child's social adjustment to other persons are by no means as simple as they appear on the surface. Even as late as the age of three, a child may not qualify for a hide-and-seek game because, ostrich-like, he thinks he can conceal himself simply by covering his eyes with his hands. Throughout childhood he may have difficulties in attaining the absolute perfections which the culture attempts to impose, even in such personal-social situations as table manners.

The culture must, of course, set ultimate goals of excellence. These, however, can be reached only by developmental gradations. Elsewhere we have detailed the growth gradients which underly the patterning of emotional and social behavior in infancy and childhood—gradients of anger, fear, affection, cooperation, competition; responsiveness to punishment and praise; the sense of good and bad, of ownership, truthful-

CHILD PSYCHOLOGY



1. Primitive kneel.

2. Swimming stage.

Over 20 stages of prone behavior precede the attainment of the upright posture and bipedal walking, six of which are shown here (above and to the right).

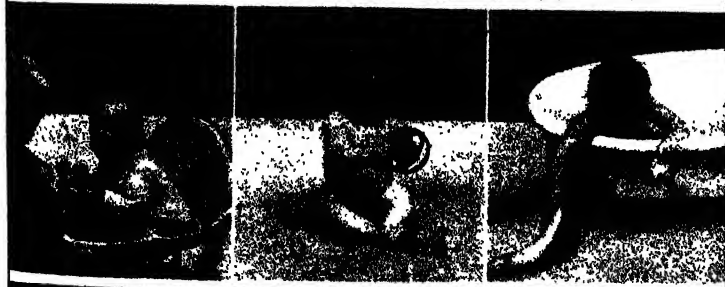
3. Pivoting crawl.



4. Frogging stage.



5. Creeping—hands and knees:



6. Creeping on all fours—hands and feet.

FOUR FUNDAMENTAL FIELDS OF BEHAVIOR.

Upper line: Posture and locomotion. Second line: Prehension and manipulation. Third line: Adaptive behavior. Bottom line: Personal-social behavior.

CHILD PSYCHOLOGY



A lawful growth sequence illustrated by cube behavior patterns. *Upper left:* A crude grasp at 28 weeks. *Upper right:* A wall at two years. *Lower left:* A bridge at three years. *Lower right:* A gateway at four years



ness, and the like.¹ Skillful and effective child guidance depends upon a working knowledge of normal gradients of maturity on the part of teachers and parents. Humane discipline is impossible without recognition of individual and maturity factors. The so-called inherent badness of children has been exaggerated by distorting interpretations and traditions. Well-constituted children with healthy inheritance have an intrinsic charm—a charm which betokens inherent goodness. The growth potentials for good far outweigh those for evil, unless the cultural odds are too heavily weighted against the child.

Consult Carmichael, Leonard, ed., *Manual of Child Psychology* (New York 1946), for a comprehensive treatise and bibliographies on child psychology. For an account of the evolutionary background, consult Keith, Sir Arthur, *A New Theory of Evolution* (New York 1949).

ARNOLD GESELL,
Yale School of Medicine.

CHILD WELFARE. The welfare of all children calls for certain basic values in heredity and environment. It is rooted in the family and in the ability of the family to provide certain advantages, beginning with good breeding, and proper nourishment and care for the mother during the prenatal months, and followed by the physical and emotional nourishment which the infant needs. As the child grows, his physical, emotional, intellectual, social, and spiritual needs require an expanding array of services, including certain provisions by the family and also education, health, recreation, and religious and welfare services provided by the government or by voluntary agencies.

Traditionally, the term child welfare has been defined with special concern for the deprived child, with emphasis being placed upon physical, mental, emotional, and moral handicaps and problems, and upon the conditions and services necessary for the prevention or correction of handicaps. In view of the limited resources of families and communities, it is practical to make certain elemental provisions for all children, such as education and health facilities, and then to develop the services needed by those with severe handicaps, such as care, training, and treatment in their own homes, foster homes, or institutions for the dependent, neglected, delinquent, emotionally disturbed, mentally deficient, blind, deaf, or crippled. Whether it be defined broadly or in restricted terms, child welfare has extended its scope as standards of living have improved and as life has become more complicated.

Child Population of the United States.—The birth rate in the United States declined from 25.0 per 1,000 population in 1915 to 16.6 in 1933. It increased during and after World War II, reaching 25.8 in 1947, when the number of registered births, exceeding all previous records, was 3,699,940. Between 1940 and 1950 the number of children under 10 years of age increased 39.4 per cent. In many communities this additional child population overtaxed the hospitals and schools.

A comparison of 1940 census figures on child population and school enrollment with preliminary data from the 1950 federal census shows the following:

	1940	1950
Under 10 years	21,226,146	29,565,000
10 to 24 years, inclusive	35,667,293	33,420,000 ¹
Enrolled in school, 5 to 24 years	26,759,099	28,391,000

¹ Decrease due to low birthrate in the 1930's.

Federal and National Agencies Serving Children.—The welfare of children has commanded the attention of the various professions active in education, health, and welfare. In addition, service to children is the sole or partial function of scores of federal and national agencies. The numbers of child welfare organizations developed during the first half of the 20th century have required the expenditure of hundreds of millions of dollars annually.

Outstanding among the units of the federal government serving children are the Bureau of Human Nutrition and Home Economics and the Food Distribution Programs Branch of the Department of Agriculture; the Bureau of Indian Affairs and the National Park Service of the Department of the Interior; several units of the departments of Justice, Labor, and State; the Office of Education, the Public Health Service, and the Social Security Administration (including the Bureau of Old-Age and Survivors Insurance, Bureau of Public Assistance, Children's Bureau, and Division of Research and Statistics) of the Federal Security Agency; the Veterans Administration; the Displaced Persons Commission; and several coordinating bodies, including the Federal Inter-Agency Committee on Recreation and the Interdepartmental Committee on Children and Youth. Some of these federal units have counterparts in the governments of states, counties, and cities: for example, the state and local educational and health authorities and the welfare authorities administering various types of public assistance and child welfare services. The tendency for the federal government to subsidize certain health and welfare services through grants-in-aid has helped to develop similar interests in these federal-state-local governmental services. Federal aid to education became a hotly contested issue in the period 1939–1950, but no law or appropriation providing such aid developed. Even where services receive federal subsidies, the administration of the work is commonly in the hands of the local or, occasionally, state government, from which the bulk of the financial support for the services is derived.

If sectarian and fraternal organizations are included, voluntary national agencies serving children number several hundred. Many voluntary services in education, health, and welfare pertain only partially to children. This is true of the work of the American Legion (Indianapolis), with its National Child Welfare Division, which is only one of the Legion's several programs, and it applies also to the American Public Welfare Association (Chicago), the National Education Association and its affiliated bodies (Washington), and the National Association for Mental Health, the National Federation of Settlements and Neighborhood Centers, the National Probation and Parole Association, the National Recreation Association, the Young Men's Christian Associations, and the Young Women's Christian Association of the United States of America, all of which have their headquarters in New York City. Restricting their services to children are the Boy Scouts of America, Boys' Clubs of America, Camp Fire Girls, Child Study Association of America, Child Welfare League of America,

¹ A. Gesell and F. Ilg, assisted by J. Learned and L. Ames, *Infant and Child in the Culture of Today: The Guidance of Development in Home and Nursery School* (New York 1943); A. Gesell and F. Ilg, assisted by L. Ames and G. Bullis, *The Child from Five to Ten* (New York 1946).

Girl Scouts of the United States of America, and the National Child Labor Committee, which also have their headquarters in New York.

White House Conferences on Child Welfare.—It has become traditional for the president of the United States at the end of each decade to call a conference in Washington, D.C., of persons qualified to study child welfare needs and resources. In addition to its inventory of conditions of children and services in their behalf, each of these White House conferences has been followed by substantial developments in child welfare planning.

The first such meeting, the White House Conference on the Care of Dependent Children, held in 1909 when Theodore Roosevelt was president, led to the establishment of the federal Children's Bureau (1912), and of the Child Welfare League of America (1920). The 1919 conference focused attention on the standards of various services to children and helped to bring about the regulation of child labor which subsequently developed in many of the states. Maternal and infancy services were promoted during the 1920's in every state with the benefit of federal grants-in-aid. Findings of the 1930 White House Conference on Child Health and Protection were recorded in 35 books and pamphlets on education, health, and welfare. The 1940 White House Conference on Children in a Democracy, with its membership limited to about 700, also considered a great variety of unmet needs and services. Follow-up work was in the hands of the National Citizens Committee, a nongovernmental body, and of a federal interagency committee. The National Commission on Children in Wartime, created in 1942, and its successor, the National Commission on Children and Youth (1946), did some of the preliminary planning for the Mid-century White House Conference on Children and Youth, held Dec. 3-7, 1950. This conference, larger than its predecessors, was attended by more than 5,000 persons, including representatives of all large citizen and professional bodies, of whom about 500 were youth delegates. These young people participated freely in discussion and study groups and in the plenary sessions of the conference.

The 1950 conference was preceded by extensive regional and local studies of child welfare needs and resources by committees or other bodies appointed by state governors. Some of these organizations were designed to operate after 1950 to continue such planning as might be needed in view of their studies and of the findings of the White House Conference. In 1949, public welfare and voluntary agencies providing foster care and related social services in Oregon arranged to have the Child Welfare League of America make a survey of their operations and a study of unmet needs.

The general theme of the 1950 conference was: "To consider how we can develop in children the mental, emotional and spiritual qualities essential to individual happiness and to responsible citizenship, and what physical, economic and social conditions are deemed necessary to this development." The inclination to account for child development as well as the specific needs of children was reflected in many of the conference's 67 recommendations, as well as in the preamble, the resolutions on following up the work of the conference, and the pledge to children approved at the closing sessions. The com-

prehensive nature of the findings was reflected in two recommendations:

(1) "That all professions dealing with children be given, as an integral part of the preparation, a common core of experiences dealing with fundamental concepts of human behavior, including the need to consider the total person as well as any specific disorder; the interrelationship of physical, mental, social, religious, and cultural forces; the importance of interpersonal relationships; the role of self-understanding; and emphasis on the positive recognition and production of healthy personalities and the treatment of variations; and that lay people be oriented through formal or informal education to an understanding of the importance of the foregoing concepts.

(2) "That steps be taken at national, state, and local levels to improve the facilities and increase the output of professional schools preparing persons for services to children."

The conference at times resembled a huge town meeting, with many of the 4,620 voting delegates desiring to speak and scores of them having the opportunity to do so. Among several controversial measures which in original or amended form survived the plenary sessions were (1) a decision to support the program recommended by the President's Commission on Civil Rights and specifically to appeal to the federal government to abolish segregation in the nation's capital, and provide there an example of a truly working democratic absence of discriminatory practices on the basis of race, creed, or color; (2) an affirmation of the essentiality of religious and ethical concepts in the development of spiritual values and the importance of religious education in homes, families, and institutions of organized religion, but also an affirmation of the principle of separation of church and state as the keystone of American democracy and a declaration of unalterable opposition to the use of the public schools directly or indirectly for religious educational purposes; and (3) approval of further federal aid to the states for educational services, in tax-supported public schools, without federal control, to help equalize educational opportunity—the issue of auxiliary services to be considered on its merits in separate legislation.

Child Health.—The chances for a child to remain alive and healthy were greatly improved during the first half of the 20th century. The mortality of children under one year of age in the United States declined from 99.9 per 1,000 live births in 1915 to 29.2 in 1950. Contributing to this progress were the increased use of hospitals for maternity care; the expansion of prenatal clinic services; the increased skill of obstetricians, nurses, and midwives; and the development during World War II of the Emergency Maternity and Infant Care program financed by the federal government and administered by the Children's Bureau. The proportion of white children born in hospitals increased from about 40 per cent in 1935 to more than 90 per cent in 1948; for Negro children in the same period the proportion rose from about 18 per cent to more than 50 per cent. Parent education in the care of children, especially of infants—a major factor in the improvement of child health—has been advanced by the distribution of millions of copies of pamphlets and books written by capable health authorities. Federal and state health agencies make some of these publications available free of charge. Nutrition has become more adequate as family in-

comes more commonly permit the purchase of wholesome food. Milk and other dairy products, as they have become more plentiful, are increasingly safeguarded by pasteurization. In addition, by 1951 one fourth of all children enrolled in elementary and secondary schools in the United States were participating in a national school lunch program.

Public health agencies provide badly needed preventive and protective measures, especially in the improvement of sanitation and in the widespread administration of prophylactic measures against several of the diseases which were characterized by high mortality rates at the beginning of the 20th century. By 1951 the number of children dying annually from diphtheria, typhoid fever, and paratyphoid fever was a small fraction of the toll taken by these diseases in 1900. Smallpox has been practically eradicated in the United States. Improved medical and nursing services and the use of modern drugs have reduced greatly the severe complications and deaths formerly caused by measles, scarlet fever, whooping cough, influenza, pneumonia, and tuberculosis. Poliomyelitis and rheumatic fever have also responded to improved treatment, although by 1951 the causes and prevention of these diseases had not been established by research. Cerebral palsy has crippled many children, and measures have been taken in many urban communities for their treatment and education. Estimates of the number of handicapped persons in the United States under 21 years of age in 1951 were as follows: rheumatic fever, 500,000; epilepsy, 300,000; poliomyelitis, 200,000; cerebral palsy, 150,000; other orthopedic handicaps, 400,000; deafness and seriously impaired hearing, 750,000; blindness and serious visual defects, 67,000.

A three-year study of child health services and pediatric education in the United States by the American Academy of Pediatrics allowed publication in 1949 of a widely accepted report (see *Bibliography*). The study was made with the cooperation of the Public Health Service, the Children's Bureau, and other health agencies. It listed four reasons why a large number of children had not received preventive and curative care compatible with acknowledged standards of good pediatric practice: (1) Parents were unable to pay for good service. (2) There was unwillingness to use, or lack of knowledge of, available facilities. (3) Services were not available within a reasonable distance. (4) There were not enough physicians well trained in the medical care and health supervision of children, especially in rural areas. The study revealed that New York had eight times as many dentists in relation to children as South Carolina, and four times as many in relation to the total population. It showed that general practitioners, many of whom were without internship training in pediatrics, handled three fourths of the medical care of children. In addition to the need for more pediatric education in medical schools, the study showed a disproportionate concentration of pediatricians in urban areas and a serious scarcity of child health services and pediatricians in rural areas.

Universities; federal, state, and local public health agencies; and such foundations as the Rochester Child Health Project (Rochester, Minn.), the Rockefeller Foundation, and the Children's Fund of Michigan have undertaken extensive research in various areas of child health. Traditionally the physical aspects of child devel-

opment have received attention, but there has also been an increasing tendency to study the emotional needs of children from infancy to adolescence.

Recreation.—Throughout the ages children have been able to play even under adverse conditions. Recreation has helped them to develop strong bodies, balanced personalities, abilities in social relations, imagination, and many skills. The organization of recreation has become characteristic of life in the United States. The production of materials and the operation of facilities have involved large expenditures by families, churches, schools, neighborhood and community organizations, and federal, state, and local governments, and commercialized recreation has become a major industry.

Several factors have led families to spend much time and money on recreation. To the extent to which the activities are wholesome, they offset some of the influences tending to weaken family life. A shorter working day and week and increased family income permit parents and children to enjoy swimming, skating, fishing, hiking, boating, motoring, and a great variety of arts and crafts. Motion pictures, radio, and television also often keep families together.

Most of the auspices under which recreation is organized represent a concern for the healthy development of children, but some of the commercial facilities and some of the play organized by gangs contribute to juvenile delinquency. Successful efforts to redirect the interests and activities of street gangs have been made by such organizations as the Police Athletic League in New York City and numerous neighborhood houses, some of which employ professionally trained group workers. Municipal recreation commissions have been developed even in small cities, and many suburban counties have such bodies. Most of these governmental projects include year-round activities which are expanded during summer vacation months.

There is great variation in the quality of facilities and leadership. Except for maintenance purposes and safety provisions, many parks, swimming pools, beaches, tennis courts, and other outdoor recreation centers are often without supervision by trained workers. Playgrounds and indoor facilities, however, are generally under the direction of leaders competent to organize and supervise sports, dramatic productions, crafts, and social activities. The recruitment and training of such leaders constitute a major service provided by the National Recreation Association. Many universities offer graduate study for those who wish to specialize in recreation, and most large recreation programs, whether under governmental or voluntary control, provide in-service training for their workers. In some parts of the United States this is one of the responsibilities of state recreation authorities.

Rural young people have been organized for recreation and other activities. Four-H clubs have thrived as motor transportation has made it easier for farmers and their families to get together, and granges, cooperatives, and other organizations have developed the social interests and activities of a large part of the rural population.

Camping has become a major recreational activity which in turn utilizes many activities. Most camps are operated on a nonprofit basis, but many are directed by a proprietor who

charges a fee large enough to make the project profitable. Pioneers in the development of summer camps on a nationwide basis were the Young Men's Christian Associations and the Boy Scouts of America, both of which have developed programs of training for camp directors and extensive literature pertaining to standards for the operation of camps. These and many other national agencies interested in camping and individuals experienced in camping have organized the American Camping Association (Chicago). Most camps aim at developing happy, healthy, self-reliant children. Some add to these objectives such specialized functions as music education, training in dramatics, and treatment for children with physical or emotional handicaps.

Play therapy has been developed by leaders in the fields of mental hygiene and psychotherapy. Research, mostly since 1930, has indicated great possibilities in this type of group work. Small groups and specially trained leaders, operating with supervision or in consultation with a psychiatrist, are essentials in a service so difficult and complicated.

WELFARE OF HANDICAPPED CHILDREN

The number of children in the United States who are dependent, neglected, delinquent, crippled, convalescent, emotionally disturbed, or mentally deficient cannot be given, partly because the legal or practical definitions of these handicaps vary from state to state and even within the same state, and partly because there are few comparable records of those needing service but unable to obtain it. Even the simpler task of accounting for those living in various types of foster homes, institutions, and residential schools has been accomplished only in part. Nor is there any enumeration of the children who receive day care, many of whom are served by women who operate facilities for profit in some communities without the requirement of a license from health or welfare officials. It was estimated at the 1950 White House Conference that one out of five mothers with children under 18 years of age works outside the home.

The federal census of *Children Under Institutional Care and in Foster Homes*, 1933 was published in 1935. Partly due to wartime economies, no such enumeration was made in 1943. The United States Office of Education in 1946 published lists of various types of residential schools, including training schools for juvenile delinquents and the mentally deficient. There then were 201 training schools for juvenile delinquents in 51 states and territories, including the District of Columbia, of which 138 were governmental and 63 were under nonsectarian or sectarian control. Children in residence then totaled 32,447. In November 1949, the United States Children's Bureau published a directory of public training schools for delinquent children, listing 171 institutions with their capacities but not their populations. The training schools for the mentally deficient numbered 163 in 1946 and were located in 45 states and territories. They reported 110,207 persons in residence, but it was not indicated how many of these were children. Chronological ages seem less important than mental ages in work with the mentally deficient; and it is not uncommon to designate as boys or girls men or women who have passed their 21st birthday.

The 1933 census report showed the number of

dependent and neglected children in foster homes to be 102,577; in institutions, 140,352. Although exact numbers have not been determined since this census, the data gathered for the 1950 White House Conference showed about 105,000 children in foster homes under the care of public welfare agencies. Those under the care of private agencies totaled about 50,000. It was reported by the Children's Bureau that about 375,000 children, including those under foster care, were receiving social case work service from public and private agencies on June 30, 1950.

Crippled and convalescent children receive care at home or in foster homes, in various types of hospitals, and in specialized institutions. The states and territories maintain registers of children who have been diagnosed by a licensed physician as having a crippling condition, but these lists admittedly are incomplete and do not reflect the number of children receiving care because they are crippled.

It is impractical to attempt to count or estimate the number of emotionally disturbed children under care in foster homes or institutions, or the number in need of such care. There is none of the legal definition of this condition that exists in services to the dependent, neglected, delinquent, and mentally deficient, although during the period 1931-1950 a number of institutions with service to emotionally disturbed children as their principal or sole function were founded or reorganized. Their clients naturally have been only the seriously disturbed, and in most states there are no facilities even for such children.

Although the exact number of those needing foster care and related services cannot be determined, it is known that in some communities there are no facilities for certain children, and that in places the facilities available do not provide for all who need them. The shortage of foster homes for children of all ages has been advertised in popular radio and news campaigns for additional homes. The lack of foster home care has been especially serious for Negro children, and there is a dearth of institutional care for Negroes even in states where segregation in such services is not the common practice.

Preventive Measures and Services.—The extent of dependency, neglect, delinquency, and emotional disturbance among children in the United States would be much greater than it is were it not for the availability since 1936 of several types of social security, notably aid to dependent children (ADC); the development since about 1925 of child-guidance clinics and related services operated by schools and social agencies; the establishment in many communities of family welfare and family counseling services; the expansion of religious services and influences; the organization and development of recreational services; the provision of probation service by juvenile courts; the increase in the facilities for day care; and the widespread development of nutritional and health services.

In January 1951, ADC was provided for 1,639,107 children in 641,397 families. The funds for ADC are derived from both federal and state appropriations, the federal government supplementing the amount provided by each state on a grant-in-aid basis. Aid is available to a parent, or to any relative of second degree providing a home for a child, who satisfies county or other local public welfare authorities that this form of assistance is needed. Unless the relative

with responsibility for the care of the child has established legal residence, however, the family is ineligible for ADC or other forms of public assistance in many states. Settlement laws have been liberalized in a number of states, however, and by 1950 seven had abolished statutory residence requirements for ADC.

Were it not for ADC, the number of children in foster homes or institutions might have doubled or trebled in the period 1936-1950. Between 1940 and 1950 the population of the United States rose 14.5 per cent, or by more than twice the percentage of the preceding decade, due mostly to an unprecedented increase in the number of children born. Yet there was no proportional increase in the number of either of the two types of foster care. An undetermined increase in the need for child care during and after World War II was reflected in the waiting lists of children for whom service in foster homes or institutions was unavailable. These facilities were noticeably insufficient for infants, adolescents, and Negro children of all ages. In addition to ADC, factors tending to keep families together have included increased wages, unemployment benefits, the reduction in illnesses among workers due to improved diet and health services and industrial safety measures, and the rehabilitation of disabled workers.

Valuable as ADC has been in the prevention of neglect and extreme dependency of children, in most states the grants have been too small to permit fulfillment of its avowed purpose. The increases authorized by most state legislatures have lagged far behind the rise in the cost of living. Recognizing the inadequacy of ADC, the United States Congress, in its 1950 amendments to the Social Security Act, added to the federal contribution for this form of assistance up to \$27 monthly for each family aided to help defray the expenses of the parent or other relative assuming responsibility for the care of the needy child or children. Even this addition left the grants so inadequate in some states that voluntary agencies, including several sectarian children's institutions in the South, provided a monthly supplement to the ADC grant for families which otherwise might have been compelled to send their children to live in an institution or foster home. In January 1951, the average monthly ADC grant per family aided ranged from \$18.38 in Mississippi to \$123.79 in Massachusetts. The inadequacies of ADC have been conspicuous because the United States is the only large industrial country without a system of children's allowances, commonly called family allowances.

Child welfare services are a major responsibility of the Children's Bureau. Under title 5, part 3 of the Social Security Act of 1935, the bureau makes grants-in-aid to state public welfare agencies in order to help them extend and strengthen, especially in rural areas and areas of special need, public welfare services for the protection and care of homeless, dependent, and neglected children, and children in danger of becoming delinquent. The services of child welfare workers thus made available have been used by families, neighbors, schools, courts, and other agencies to ascertain how the needs of socially deprived children can best be met.

The 1950 revisions of the Social Security Act included authorization of aid for the return of children who run away from home to another state in cases in which such return is in the

interests of the children and the cost cannot otherwise be met; and a provision that, in developing public child welfare services, "the facilities and experience of voluntary agencies shall be utilized in accordance with child-care programs and arrangements in the states and local communities as may be authorized by the state."

Boys or girls whose delinquency has brought them to a children's court or court of domestic relations are often returned to their parents under some plan acceptable to the court and to the parents. Some of these children are kept under the supervision of the court's probation staff. Probation is often used in preference to commitment to a training school for delinquents, such commitment still being too commonly the recourse of those courts operating without probation officers or courts in which neither the judge nor the probation staff is professionally qualified to understand and serve children. In only about half of the 3,069 counties in the United States is there provision for probation service in courts with jurisdiction in juvenile cases, and many probation officers are untrained. Probation may be provided for a child in his own home or in some place outside his home. The use of the homes of relatives, foster homes, institutions for dependent and neglected children, boarding schools, and centers for the study or treatment of emotionally disturbed children allows flexibility in dealing with the varied individual and family problems underlying delinquency. Just as ADC often prevents dependency from becoming acute, so probation permitting the effective use of various facilities by the court avoids the confirmation of delinquency so frequently resulting from commitment to a training school for delinquents.

Child guidance services provided by school social workers and child guidance clinics have proved highly effective in the prevention and correction of severe emotional disturbance and delinquency among children. The early detection of emotional distress or wayward tendencies in a child may spare him mental illness or delinquency and the unhappiness such maladjustments, if ignored, will impose. It has become obvious that teachers in elementary and secondary schools are able to detect such problems, just as they note obvious physical handicaps in time to permit early treatment. Social workers, as they become acquainted with children and families, also are in a position to refer children for psychiatric service during the early stages of behavior disorders. Thus the staff of a child guidance clinic can obtain results earlier and can be more effective than in cases when the child comes with a long-established pattern of disturbance or misbehavior. Juvenile courts increasingly rely upon the psychiatric services of child guidance clinics, and a few courts have their own psychiatric staffs. The development of mental hygiene and child guidance services during the period 1921-1950 has helped court officials and the general public to understand that many delinquents are so disturbed emotionally as to need treatment, and that the root of most delinquencies may be found in emotional disturbance. Many of the emotionally disturbed, however, are not delinquent. Serious and prolonged disturbance may lead to mental disease requiring treatment and care in a mental hospital by the time the child becomes an adolescent or an adult. Other children are restricted only in

their ability to live happily and effectively because of the depression or confusion which typifies their distress. Fortunately, most of those in need of psychiatric service can be treated while living at home and without interruption of their education, work, or other activities.

Remedial instruction for children with neurological, emotional, or mental handicaps, provided in the schools or on a tutorial basis, is another corrective measure developed since the early 1920's. Without such assistance many with reading difficulties grow up unable to read a newspaper or working instructions. Unless they are given corrective training, those with faulty speech also find difficult or impossible ordinary communication essential in obtaining employment or in living happily with others. Earlier in the century, and in many communities even in 1951, youth and adults with such handicaps were tragically misjudged and were frequently considered mentally deficient.

Special classes in the public schools permit many mentally deficient children to learn enough to compete with their more intelligent fellows in industry and other occupations and to function as useful members of society. Without this help many such children would flounder in unsuccessful efforts to learn under the ordinary curriculum and would become discouraged and defeated.

Family welfare services, available in most large cities, were founded in the 19th century as voluntary agencies providing relief. As public welfare became more adequate and as social security became available, most family service societies greatly reduced their relief programs. Increasingly, their efforts have been concentrated on social case work and related services whereby families are strengthened, individuals are aided to develop effective social relationships within and outside their families, and families and individuals are helped to meet problems which threaten their welfare. The prevention of family disintegration by such agencies has reduced the number of children needing foster care. Family service societies have also been effective in rehabilitating families, thus allowing children who have required foster care during a period of crisis to return to their homes when the crisis is over.

Homemaker service, developed in only the largest or socially best-equipped cities, is one of the most effective services holding families together when illness or other emergency situations remove the mother or place her temporarily in need of assistance. When a mother is in confinement, and sometimes after her return from the hospital with a new baby, a homemaker operating under the supervision of a social agency looks after the other children. The economy of this service is obvious, especially in large families where it would cost much more to place several children in foster care than to pay the salary of a homemaker. In terms of the emotional security provided for children, it warrants further organization and use.

Visiting nurses have played an important role in reducing morbidity and mortality among children. In addition to their own services, they contribute to the community's efforts to prevent the development of serious health and welfare problems by referring families to other agencies when there is still time for preventive services.

During World War II day care became one of the best-known and most widely used com-

munity services to children. Congress authorized the subsidy of child care centers by including day care among the activities covered by the Lanham Act of 1942. Under its appropriations religious and nonsectarian agencies expanded existing day care services or established new day nurseries. These services were insufficient to care for the large number of preschool children whose mothers were absent during the working day and who had no other adult in the home to provide supervision. Consequently, many independent proprietary day care services were organized, some of which were of good quality, but many of which were seriously substandard. With all its inadequacies during and after the war, however, day care has been a valuable and economical child welfare service without which many children would have been sorely neglected and in danger of serious accidents, ill health, or associations predisposing them to delinquency.

Other preventive measures and services might be listed, but these well-known provisions illustrate the tendency of professional workers and those responsible for legislation and social planning to attack the causes of child welfare problems. This trend is important in view of the palliative efforts, sometimes under unskilled leadership, whereby communities traditionally still provide for children handicapped by dependency, neglect, delinquency, emotional disturbance, or mental deficiency.

Dependent and Neglected Children.—

Services to dependent and neglected children in the United States, rooted in the customs of other lands and notably in the English poor laws, have grown from meager and often miserable beginnings. The indenture of children, which placed as much emphasis upon the services that the child was to perform as upon his shelter, clothing, food, and training, placed a price on the child and what he was to give and receive. The care of children in almshouses, where they lived with indigent, diseased, and sometimes vicious adults was common in the 19th century and still persisted in backward communities even after 1900. Placement for adoption or care in other types of foster homes took the place of indenture; and the orphan asylum, orphanage, or children's home displaced the almshouse for purposes of child care and the relief of dependency and neglect. Even though indenture is no longer tolerated, a practice almost as questionable—though in many states illegal—still exists in the placement of babies for adoption by individuals who receive a substantial payment for each child thus purchased. Less objectionable but also undesirable are the substandard services found in family boarding homes and children's institutions due to inadequate budgets; lack of skill in administration, social service, and child care; and overloads carried by social workers, foster mothers, and institutional personnel. The evolution of child welfare will proceed only at a slow pace in many communities until radical changes have been made, especially in the displacement of unskilled leaders by workers professionally trained to serve children.

Among the most important changes in the 20th century have been the improvements in service whereby dependency, neglect, and other handicap may be identified. The professional education of social workers, psychiatrists, and others engaged in child care has been paralleled by the development of organized services essential to the suc-

cessful treatment of children's problems. Social case work as practiced in family service societies, children's aid societies, adoption agencies, and various types of institutions has placed emphasis upon understanding the relationships within families and the development of children. The social worker, sometimes designated as the case worker, usually emphasizes rehabilitation of the family, wherever practical, and the development of well-balanced personalities. As this influence has been felt, the average length of the period of care or treatment required for dependent and neglected children has been shortened. In 1920 it was common for children to remain in a foster home or institution for 5 to 10 years or even longer. A few children need such long-term care even where there is adequate social case work. But the average period of care required by most dependent and neglected children may be measured in months instead of years. The progress thus made is comparable to the improvements in surgery and hospital care whereby a person recovering from an appendectomy in 1951 remained in the hospital less than half the time common for such patients in 1930. The social economy reflected in this shortening of the length of foster care, both in foster homes and institutions, may be measured in different ways. It means conservation of family ties, which are apt to be weakened or severed if a child is separated from his parents for years. The child and family derive greater security when they are reunited at the earliest time consistent with wholesome relations. The space in the foster home or institution will serve more individuals within a year than when long-term care was common. Some institutions, with the same number of children in residence on a given day, served twice as many in 1951 as they did in 1930. Even though the per capita daily cost of child care rose sharply because of the increased cost of living and the much needed improvements in service, the total cost of a child's care was less in 1951 if he remained under care only six months as compared with the two years he might have remained in 1930.

A double burden of dependency and neglect is often observed by those who serve children requiring foster care. The economic, physical, mental, and emotional pressures which create dependency in a family may also make parents neglectful. Moreover, the parent inclined to neglect his child because of emotional conflict and confusions in his family relationships is apt to have his earning power curtailed and his ability to support his child reduced to the extent that dependency is created. The two conditions do, however, exist separately.

A child may be dependent and still have one or both parents who love him and are capable of satisfying his basic emotional needs. A widower or widow may be unable to earn a living and also to maintain a home, and be compelled to ask a social agency to accept one or more of his or her children for foster care. The parent confined to a hospital with a long illness, as with tuberculosis, may require for medical and hospital expenses the funds needed to maintain the home and to provide substitute parental care. In most states it is a simple procedure for the city or county department of public welfare to commit such a child to a child-placing agency or institution, with the understanding that the parent will pay something toward his support if the

family budget permits. Whether there is such payment or not, it is common practice for the committing authority to return the child to his parents when they are ready to provide a home for him. In a few states and local jurisdictions the law requires the action of a juvenile court before a child may be declared a dependent and be entitled to support as a public ward. Increasingly, since the passage of the Social Security Act of 1935, and the subsequent development of child welfare services by county welfare authorities, the courts have left to these authorities jurisdiction in all matters pertaining to dependency. Such jurisdiction has been provided for in the revision of children's codes in several states. Dependency is often recognized by voluntary arrangements between a parent and a nonsectarian or sectarian child-caring agency or institution. In the first quarter of the 20th century there was a tendency for such organizations to have a parent sign a formal surrender of his child. Legal decisions repeatedly declared such surrenders invalid when a competent parent claimed his child in opposition to the claim of a social agency reluctant to return him. Another reason for avoiding the use of surrenders is the tendency of social workers and social agencies to do all they can to keep intact those economic and emotional ties between parent and child which the act of signing a surrender tends to dissolve. Sometimes physically handicapped children requiring prolonged hospitalization are declared legally dependent in order to permit public authorities to pay for all or part of their treatment.

A neglected child is one whose relatives or guardians fail to perform their duty, do not provide a proper home, do not care properly for him, or treat him with cruelty. There are various degrees of neglect, ranging from the failure of a mentally deficient parent to support his child to the willful rejection by a parent of one or more of his children (as in cases of abandonment), the instruction of a child in immoral practices, or the use of physical punishment which injures the child. Extreme neglect may warrant depriving the parent of his rights as guardian and custodian of his child. In contrast to dependency, neglect may require the action of a juvenile court in transferring guardianship, custody, or both to a child care agency or to a responsible and interested individual, or in requiring a parent to contribute to the support of his child. Such court orders sometimes are issued to fathers of children born out of wedlock whose paternity has been established by legal action.

Much of the neglect of children reflects only the ignorance, immaturity, or emotional distress of one or both parents. Consequently, children's protective services operated on a case work basis seek and obtain the cooperation of most parents against whom complaints of neglect are filed. Parents whose neglect of their children has been serious or even cruel respond in some cases to sympathetic and skillful efforts to help them understand their children and themselves. This development is in contrast to the authoritative and even punitive attitude of the early efforts of children's protective societies, and of some of the social service still provided in 1951 on that basis.

Juvenile courts and courts of domestic relations may also be classified according to their inclination to obtain the cooperation of parents or to coerce or punish them. In most cities and

counties in the United States there are no children's protective societies. In such communities the police, public welfare workers, and the court probation officers respond to complaints of the neglect of children.

Even where neglect warrants the removal of a child from his parents, there is a tendency to rehabilitate the home when it seems in the best interests of the child. In certain cases where there is improper guardianship, however, parents are even denied the right to visit their children in the foster homes or institutions to which they have been committed. Those who work effectively with neglected children acquire legal knowledge, especially with reference to guardianship and custody. A publication of the Children's Bureau helpful in this connection is *Guardianship: A Way of Fulfilling Public Responsibility for Children* (see *Bibliography*).

Improved services for children, especially in the fields of health and welfare, are patronized increasingly by parents, able to pay for the entire cost of service, whose children cannot be classified as dependent or neglected. Many widowers have found the employment of housekeepers unsatisfactory and have turned to child-placing agencies for foster home care for their children. Families of children who are emotionally disturbed or who have other handicaps often find in foster homes or institutional care of high quality the best available service. The second half of the 20th century may see extensive use of such services by those able to pay all that it costs, just as the first half of the century saw the use of hospitals by private patients become increasingly popular.

Care in Foster Homes.—The care of dependent and neglected children in foster homes is given mostly in boarding homes. Other types are adoptive, free, wage, and work homes. Boarding homes include subsidized foster homes, used especially for temporary care, where experienced foster parents are ready day or night to receive children in need of emergency shelter or detention. In such a home a fixed payment is charged for each bed kept available even when it is not in use, and a larger amount is paid for each child under care. There are also specialized foster homes for specially handicapped children, where a physical or mental infirmity receives the attention of a nurse who is also the foster mother. Dependency or neglect is usually an additional handicap of such children, who otherwise might have nursing care in their own homes.

Adoptions usually involve infants, most of whom are the children of unmarried mothers. There is a tendency to arrange adoptions for a few older children, including those of school age—children without relatives to provide suitable care who otherwise would spend years in boarding homes or institutions. The demand for babies consistently has been greater than the supply of those available for adoption, even though an increase in the number of children born in the United States, including an increase in the number born out of wedlock, has overtaxed the facilities of accredited adoption agencies. Such agencies first screen the large numbers of applications of couples seeking to adopt children and then study carefully the family situation of those who satisfy the initial requirements. By 1951 adoption studies, which in earlier years were usually superficial, stressed the emotional stability and compatibility of the adopting parents and their capacity to love an adopted child until he should become an adult,

with due attention being given to the ability of the foster parents to maintain a home and to provide the religious, moral, and social influences expected of parents. It is customary to approve for adoption of babies only those foster parents under 40 or 45 years of age. Common practice, required by law in most states, allows the completion of adoption only after the child has lived in the foster home for a trial period of a year or more.

In contrast to the oversupply of adoptive homes is the scarcity of boarding homes. The radio, press, and other channels of communication have been used in campaigns to recruit this type of foster home. Factors restricting the supply of suitable boarding homes are the scarcity of housing; the construction of apartments large enough only for childless couples; the demand for women workers in business, industry, and the professions; and inadequate rates of board paid to foster mothers. The need for boarding homes is especially acute for Negro children and for those of other racial groups for whom suitable housing has been scarce because of discrimination and other disadvantages. Rates of board were doubled by many child-placing agencies during or after World War II. The study of the situation by the Child Welfare League of America and other organizations led to the analysis of board rates and to more adequate provision for the expenses of those caring for a foster child. Basic rates for board commonly include amounts covering the child's share of the family budget for food, laundry, fuel, light, and rent. In addition to the basic rate, the payment for board usually includes the cost of clothing, school supplies, transportation, haircuts, and spending money. A few agencies also add an amount to compensate the foster mother for her services. In 1951, however, the situation was still complicated by rates of board so low as to require foster parents to be philanthropists to the extent of paying for several of the items essential or desirable in the care and training of their foster children.

Serious hazards in foster home services are the circumstances, sometimes unpredictable, which require re-placement of a child, and the inclination of some social workers and agencies to use substandard homes or to place in one home more children than the foster mother can properly serve. The law in many states limits to six the number of children who may be cared for in one foster home and requires the licensing of foster homes by a public welfare agency. The scarcity of qualified social workers, the limited budgets of child-placing agencies, and the insufficiency of foster homes have led to the overloading of workers responsible for finding and supervising foster homes.

Reliance upon free foster homes has decreased as the use of boarding homes has increased. At one time large groups of children from Eastern cities were taken by child-placing workers to the Middle West, mostly for placement in rural homes; this practice was discontinued by 1920. In several respects these free home placements resembled indenture. The foster parents chose the child with little or no study of their qualifications to provide suitable care and training; there was no regular supervision of the child after placement; the placements were too far away to permit visits by the child's relatives; placement at a distance discouraged efforts to return the child to his parents; and in most cases the child's fitness as a farm or domestic helper, or the likeli-

hood of his becoming a capable worker, was implicit in the application for a child. Many states have statutes controlling and discouraging the placement within their boundaries of children from other states, and bonds are required in some jurisdictions before an agency may bring a child from outside the state for placement in a foster home. There continues to be some use of free homes and some reliance in the care of adolescents upon wage or work homes. With skillful home finding and supervision there is a place for these types of care, although they are suitable for only a few of the children needing foster homes.

Care in Institutions.—There are in the United States approximately 1,600 institutions serving dependent and neglected children. Of this number, about 400 are under Protestant sectarian auspices, almost 400 are operated by the Roman Catholic Church, and a few are run by Jewish organizations. More than 500 are under non-sectarian control, and about 200 are operated by state or local governments. Approximately 10,000 of the 140,000 children in such institutions are in those under government administration. This proportion is in contrast to that prevailing in foster home service, in which about two thirds of the children are under the care of government agencies. Approximately three fourths of the institutions have fewer than 100 children in residence, and it has become increasingly common for them to provide for some of their children in foster homes.

Most institutions built since 1910 have utilized the cottage plan, the group in each cottage ranging from 10 to 25. There are some cottages for more than 25, but child welfare authorities are inclined to consider these larger living groups as congregate units. In the 19th century most institutions were congregate, sometimes with 100 to 500 children living in one building and 40 or more children sleeping in one room.

Institutional care, typified by function, includes temporary service for purposes of shelter; reception, pending placement in foster homes or referral to other institutions; and observation or study. Where residence for several months or years is anticipated, the institution usually regards foster care as its primary responsibility. For older children training is often an avowed purpose, very much as in a boarding school, and this training may include prevocational activities or preparation for study beyond high school. Some institutions are inclined to specialize in the treatment of emotional problems or handicaps which require remedial teaching, this policy being based on the presumption that most children uprooted from their own homes are confused or disturbed to the extent that they need these specialized services. A modern institution regards itself as an advocate for the child, providing the social service necessary to safeguard such kinship ties as he possesses and to prepare for his return to his family. Visits by parents are encouraged, and plans are often made for children to spend holidays with relatives. This type of service is quite different from the custodial service which formerly characterized most institutions and often is still found where no social case work has been done in behalf of the child and his family, and where a child's admission to an institution is considered the complete plan instead of one step in dealing with his dependency or neglect. Increasingly, institutions provide a balanced service in which social worker, teacher, physician, dentist,

nurse, recreation worker, and house parent work together to help the dependent child to become independent, and the neglected child to achieve security. The various professions may all be included within the institution's staff, but often, and to the child's advantage, professional workers in a nearby community are members of this team. The use of neighborhood and community facilities helps to offset the regimenting influences of institutional life.

Institutional care for infants and preschool children has been severely criticized because young children need more affection and individual attention than can be supplied in most institutional environments. Some children of school age also require more love and attention than it is practical to provide in an institution. This is true even of some adolescents, but there is more value in group life for them than for younger children. After puberty children are more gregarious than at earlier ages, and the natural revolt of adolescents against adult authority in the home makes life in an institution or boarding school practical for many of them.

Modification of congregate care has been made possible by the reduction of the population of many institutions, a change which in turn has permitted the reduction of the size of dormitory groups. It was not uncommon in 1951 to find a unit of 10 or 15 children under one housemother in a room or suite of rooms previously crowded with 25 or 30 children. This change was made possible partly by improved social service, whereby the average length of institutional residence was greatly reduced, sometimes to less than half what it had been a few years before. Under such conditions many of the advantages of small cottage units could be realized. But the more usual situation was the overloading of workers with groups of children so large as to make regimentation unavoidable.

The development of small cottages has permitted a type of institutional care previously impractical. The freedom from restraints in a cottage of 10 or 12 can be approximately the same as children enjoy in family homes. Such a cottage usually is a complete living unit for children and house parents, with kitchen, dining room, living room, playroom, sewing room, storage spaces, sleeping quarters, and bathrooms. Some cottages have individual bedrooms for a few children, and the dormitories in small cottages seldom contain more than three or four beds.

The creation of cottage life and the greater freedom in the lives of the children call for house parents more capable than the matrons and attendants who formerly regimented boys and girls in congregate dining rooms and dormitories. Most institutions seek as house parents workers with education and such interest in their work as will qualify them for the study of child development and other subjects included in staff training classes. House parents are expected to cooperate with social workers, nurses, psychiatrists, and others who are working intensively with particular children. A cottage may have only a housemother, but there is a tendency to employ a married couple so that the children may have the influence of both sexes, as in a family home.

Delinquent Children.—Nearly all delinquent children for whom courts decide there should be care outside their own homes are committed to training schools, two thirds of which are under

government auspices. Detention homes, usually operated by county or municipal juvenile courts, play an important role in the care of children alleged to be delinquent, before and after their appearance in court and pending their admission to training schools. The detention of juveniles increasingly is provided in subsidized foster homes, a practical arrangement in thinly populated communities where an institutional detention facility may be unoccupied for periods of weeks or even months. Too often, however, children are detained in jails, sometimes without segregation from adult prisoners.

Even a few days in a substandard detention home often leaves a child shocked and embittered. This is true of those who continue on their way to a state training school for delinquents as well as of those who are returned to their own homes. Sometimes a child held as a material witness, as in cases where he or she has been the victim of a vicious attack by an adult, is compelled to live with delinquents in a detention home or jail. Studies made by the National Probation Association (now the National Probation and Parole Association) in 1945 described serious inadequacies in most detention facilities and indicated a lack of facilities in many communities. The association emphasized the need for a variety of facilities, including boarding homes or small home-like shelters for children who do not require security detention. For a rural county which cannot afford to construct and maintain a modern detention home it recommended cooperation with other counties in the operation of a regional home. Reduction in the length of detention through the prompt disposition of cases by courts is a common need. To spare children a detention experience is desirable whenever the situation warrants keeping the child at home or providing other types of care. In addition to custody, detention should provide medical, educational, recreational, and religious services and influences, in keeping with the best practices in child development and child care.

Training schools for delinquents have evolved from the houses of refuge established in Boston, New York, and Philadelphia in the 1820's, and from the reform schools which most of the populous states were operating by 1860. An unfortunate heritage is the congregate nature of most of the work. Although it obviously is more difficult to serve delinquent children effectively, the dormitory or cottage groups in training schools usually are larger than they are in institutions for dependent and neglected children. There is a marked tendency to reduce the size of school-room classes and work groups in training schools, but the congregate dormitory, sometimes a unit for 30 or 40 in one "cottage," has seldom been replaced. Mass treatment tends to provide training in vicious habits and preparation for crime more often than it produces the rehabilitation so badly needed by those who have become delinquent.

Few training schools operate on budgets large enough to permit the elimination of the overloading of workers and the mass care and training which still persist. Larger staffs and more capable workers are employed in states where the funds for the care and training of delinquents are most adequately provided. In 1951 it was apparent that if the training and treatment of juvenile delinquents was to become effective, the per capita cost would be nearly as great as the

cost for hospital services for medical and surgical patients. The greatest additional outlay needed in most institutions was for larger staffs, including highly qualified teachers, social workers, physicians, nurses, recreation leaders, and house parents. Many institutions in 1951 provided an unattractive and nutritionally inadequate diet, another condition due to limited budgets and poorly qualified staff. If mass care and treatment was to be eliminated, large amounts must be spent in replacing obsolete dormitories with cottages for as few as 10 or 15 children.

Training schools for delinquents are asked to serve boys and girls with whom homes, schools, churches, and social agencies have failed. Occasionally, a judge will commit a neglected or mentally deficient child to such an institution, a practice more common when the resources for serving handicapped children were less specialized. Most of those responsible for the commitment or admission of children to training schools are still inclined to be more concerned about the child's misbehavior than about his problems. Treatment and rehabilitation, however, are replacing the concepts of trade training and reformation which still characterize much of this work. In the states where the greatest progress has been made, there is a tendency to commit to training schools only the seriously delinquent. To allow further specialization, the state of New York in 1947 opened in Orange County its New Hampton Security Annex of the New York State Training Schools for Boys. There the two large and relatively open training schools sent their most highly disturbed boys, many of whom were chronic runaways and some of whom had committed holdups, stabbings, assaults, homicides, or sex offenses. This new institution, with a capacity of only 60 boys, has a staff ratio of more than one worker to two boys. There are three psychiatrists on the staff, each spending one day a week at the annex, each with no more than 20 boys to serve. Even though the boys live in cell-like rooms in one congregate building, the individual treatment thus provided has produced favorable results in most cases. In 1951 about one third of the boys went without an accompanying adult to work occasionally or regularly at agricultural or other employment outside the institution. Here, as in the best-staffed training schools, fear, repressions, and severe punishments are recognized as inadequate influences tending to aggravate the children's problems. Conscientious and consistent efforts are made under psychiatric guidance to develop confidence through the progressive use of freedom and the recognition of achievement.

Emotionally Disturbed Children.—Treatment centers for emotionally disturbed children have been developed under both government and private auspices. Some institutions have been founded for this purpose, and others previously caring for dependent, neglected, or delinquent children have developed treatment as a function, in some cases as their only function. The varying degrees of proficiency of those providing this service, and the different psychological approaches to the treatment of behavior, make it difficult to classify such institutions except in cases where they restrict their work to treatment and have a professional staff sufficient to sustain such treatment.

Well-known institutions for dependent and neglected children which have become treatment

centers for the emotionally disturbed are Bellefaire, Cleveland, Ohio; Ryther Child Center, Seattle, Wash.; and St. Christopher's School, Dobbs Ferry, N. Y. Outstanding among the training schools for delinquents which have adapted their functions to provide psychiatric treatment is the Hawthorne-Cedar Knolls School, Hawthorne, N. Y. These four institutions serve boys and girls, a distinct advantage in view of the monastic traditions which in most institutions for delinquents, and in many of those for dependent and neglected children, have imposed separation of the sexes.

The use of the group in psychotherapy in such centers has been studied and applied to the extent that other institutions, especially training schools for delinquents, are recognizing values in group care which traditionally have been ignored. The treatment of many of the emotionally disturbed includes a phase of study, either at the treatment center or before admission, and placement with relatives or in foster homes as treatment progresses and as the child is ready to maintain the relationships necessary in family life. Research on the development of study homes and residential treatment centers for such children had been completed or was in process in 1951 under various auspices. The Child Welfare League's two-year study, to be published in 1952, covered programs under the leadership of psychiatrists, social workers, and members of other professions.

Mentally Deficient Children.—The development of institutional facilities for mentally deficient children, dating from about 1850, lagged behind the establishment of institutions for juvenile delinquents. Almshouses, prisons, and mental hospitals continued even into the 20th century to serve as catchall shelters for many whose lack of training or inability to profit from training left them unable to compete with more intelligent children.

Even in 1951 the overcrowding in training schools for the mentally deficient was worse than in any other type of institution serving children. Most institutions then had beds in corridors, and in some the congestion was so great that many were required to sleep on floors. For the most part the facilities were congregate, with 60, 80, or more beds in each dormitory. One of the happy exceptions was the Southbury Training School, Southbury, Conn., an institution for about 1,400 on the cottage plan constructed in 1939-1940. There, only the idiots and imbeciles were in hospital-like units with congregate wards. The rest of the children and adults were in cottages for 18 or 36, each cottage with its own kitchen and dining room.

The training schools serving the state of New York operate, in addition to their large institutions, cottage colonies located in rural neighborhoods or in small cities. In these units, where 20 to 40 live apart from the rest of the institution, those nearly ready for discharge are trained. They are given household duties and work experiences resembling the responsibilities which they will carry after leaving the institution. The first extensive development of the colony system was made by the Rome State School, Rome, N. Y.

Early leaders in this field of service came from the professions of education and medicine, and through the years the administration of most training schools for the mentally deficient has been characterized by the teachings and terminology of either educators or physicians.

Dr. Walter E. Fernald, who in 1887 began his work at the Massachusetts State School for the Feeble-Minded, at Waverly (now the Walter E. Fernald State School, Waltham), continuing there until his death in 1924, was the pioneer physician whose leadership extended throughout the United States and to other countries. He organized the clinical study of the mentally deficient and developed criteria for the diagnosis of mental deficiency. A center of educational leadership in this work was developed after 1888 at the Training School, Vineland, N. J., where Edward R. Johnstone (from 1889) administered a service soon characterized by research and by a program of training for psychologists and educators. These leaders and their associates and successors have helped all those who serve effectively the mentally deficient to understand the various types of mental deficiency and factors contributing to this handicap, including heredity, injuries to brain tissues, and deficiencies in the development of the brain.

The mentally deficient are commonly divided into three groups: idiots, imbeciles, and morons. Many morons can be educated and trained so that they may adjust effectively in society and become useful workers in agriculture and industry. Idiots can do little or nothing to take care of even their elemental needs, such as feeding themselves; but efforts to train imbeciles have allowed many of them to perform simple tasks, attend to their personal wants, and observe elementary rules of hygiene. As skills in service to the mentally deficient increase, and as research progresses, there are fewer of the errors in diagnosis and classification which in the past led to the commitment to training schools of a few who needed remedial education or medical service—for example, some of those with cerebral palsy or epilepsy whose intelligence had been concealed by their handicap. The intelligence tests used in determining mental deficiency are considered valid for this purpose only when they are correlated with medical findings and social criteria.

Parents of mentally deficient children have organized for purposes of cooperation with those who serve their children. The National Association of Parents and Friends of Mentally Retarded Children is interested in child care and training both at home and in school. Several training schools for the mentally deficient have parent associations. See also CHILD LABOR; CHILD PSYCHOLOGY; CHILDREN, DISEASES OF; CHILDREN'S BUREAU; MENTAL RETARDATION; SOCIAL SECURITY; and separate articles on leading national organizations concerned with the welfare of children.

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HOWARD W. HOPKIRK,
Senior Consultant, Child Welfare League of America.

CHILDBIRTH. See OBSTETRICS.

CHILDE HAROLD'S PILGRIMAGE, a poem by George Gordon Byron (q.v.). Despite diversity of critical opinion and the fact that it has become hackneyed through use in guidebooks and school readers, *Childe Harold* still remains the most famous descriptive poem in English. It was written, says Byron, "as a mark of respect for what is venerable and of feeling for what is glorious." The poem is divided into four cantos aggregating 4,500 lines; its meter is the nine-line stanza of Edmund Spenser's *Facrie Queene*. Though usually termed a descriptive poem, *Childe Harold* is really a series of descriptive, reflective, and lyrical stanzas strung on a slender thread of narrative formed by the wanderings of its eponymous hero through the countries described. But Harold, who figures only slightly in the first three cantos, and who disappears entirely in the fourth, was, in spite of Byron's strenuous denial, never other than the poet himself.

Byron's travels through Portugal, Spain, Albania, and Greece in 1809 and 1810 furnish the subject matter for cantos 1 and 2, which, upon their publication in 1812, caused their author to exclaim, "I awoke one morning and found myself famous." Their popularity, such as few poems have ever attained, was due largely to their posing, their showy rhetoric, and their satire, which exactly suited the taste of the age. Except for the fine stanzas on Greece (canto 2, stanzas 73-90), however, they contain little of value. But the third and fourth cantos, published in 1816 and 1818, respectively, belong to a higher order. His earlier poses and affectations are now laid aside, and his style is direct and mature. Canto 3 is devoted to Waterloo, the Rhine, and Switzerland; canto 4, to Italy; with their landscapes, historical associations, great men and great events, cities, buildings, and works of art. But not one half of the matter is descriptive, for the poet usually passes into reflection, and from this into the purely lyrical. In Italy his wanderings are easily traced, from Venice through Ferrara and Florence southward to Rome, but *Childe Harold* is far from being a guidebook. Byron selects only what arouses his emotions, and presents objects only as colored and interpreted by his own personality. Yet so essentially just and adequate are many of his descriptions, such as those of Venice, Rome, the Pantheon, and the gladiator, that they have become identified with the objects they describe. The contemporary popularity of *Childe Harold*, however, was not due solely to the splendor and energy of these descriptive passages. The spirit of the age spoke in its pleas for justice and liberty, and for social, political, and religious reform; and contemporary interest was quickened by the reflections on the French Revolution and Napoleon, and by political allusions and prophe-

cies. Added to all this was the daring revelation of the poet's own complex and brilliant personality.

Despite the diversity of critical opinion, it may safely be said that *Childe Harold* contains much poetry of a high order, particularly passages on the Rhine (canto 3, stanzas 50-56); on night and storm on Lake Geneva (3, 85-97); on the marble cascade (4, 69-72); on the ocean (4, 178-184). Again, Byron's historic imagination can summon "the glory that was Greece, the grandeur that was Rome," and make the reader feel the desolation of once great and now fallen states: on Athens (canto 2, stanzas 73-90); on Venice (4, 1-19); on Rome (4, 78-82). With all its lapses into empty rhetoric, its moral platitudes, its ostentatious parade of the poet's "bleeding heart," *Childe Harold* still possesses, as Algernon Swinburne said, "the splendid and imperishable excellence of sincerity and strength."

MARION TUCKER.

CHILDE ROLAND TO THE DARK TOWER CAME, a poem by Robert Browning.

One of the most powerful and impressive of Browning's shorter poems, *Childe Roland* is a narrative monologue in which "Childe" (meaning young lord) Roland, a medieval knight, tells the story of his quest of the "dark tower," though to whom he speaks, and when, and where, we never know. The poem, which is in 34 six-line stanzas, was written in one day, Jan. 3, 1852, in Paris, and was first published in the volume entitled *Men and Women* in 1855. Its title was suggested by a single disconnected line spoken by Edgar in *King Lear*: "Child Rowland to the dark tower came" (Act 1, scene 4, l. 187). Its grotesque imagery is perhaps to be understood only in the light of the unreal and fantastic world of Edgar's fancy. The strangely impressive setting presents a series of pictures as by Albrecht Dürer, in turn terrific and grotesque, fantastic in the general impression but sharply realistic in detail. In spite of Browning's assurance that the poem is "only a fantasy," commentators have offered various interpretations of its supposed allegory, not one of which is without inconsistencies. Probably the poem is best taken simply as an effort of the imagination from which each reader may gain what he will. Possibly a broad and safe interpretation is that *Childe Roland's* quest is the journey of life, with its dangers, failures, and successes, its pursuit of an ideal through perils both real and imaginary, and its final triumph through sheer power of will. The climax of the poem is superb in the crashing finality of its long-drawn trumpet blast, defying fate and all unseen malignant forces, and claiming victory even in the midst of apparent defeat.

MARION TUCKER.

CHILDEBERT, chîl'dé-bêrt, Fr. shêl-dé-bâr', the name of three Frankish kings of the Merovingian dynasty.

CHILDEBERT I (c.495-558) succeeded to the kingdom of Paris in 511 on the death of his father, Clovis I. When his brother Clodomir, king of Orléans, died in 524, Childebert and a third brother, Clotaire I, king of Soissons, killed Clodomir's two eldest sons and seized his dominions.

CHILDEBERT II (570?-596) was proclaimed king of Austrasia in 575 on the death of his father, Sigebert I. In 592, on the death of his

uncle, Guntran, he also succeeded to the kingdoms of Burgundy and Orléans and to part of Paris. CHILDEBERT III (c.683-711) was proclaimed king of Austrasia and Neustria in 695 on the death of his brother, Clovis III. He was king in name only, however, real power being exercised by the mayor of the palace, Pepin of Herstal.

CHILDERIC, *chīl'dēr-ik*, Fr. *shēl-dā-rēk'*, the name of three Frankish kings of the Merovingian dynasty.

CHILDERIC I (437?-481) became king of the Salian Franks about 458. As an ally of Rome he fought the Visigoths in 463, and later waged war on the Saxons. His capital was at Tournai, where his tomb, containing numerous examples of Merovingian art, was discovered in 1653.

CHILDERIC II (c.653-673) in 660 became king of Austrasia; in 670, on the death of Clotaire III, he also succeeded to the throne of Neustria and Burgundy. Three years later he was murdered.

CHILDERIC III (c.714-751), the last Merovingian ruler, was recognized as king of Austrasia and Neustria in 741 by Carloman and Pepin the Short. He never exercised any real power, however, and in 751 he was dethroned.

CHILDERMAS DAY. See INNOCENTS, FEAST OF HOLY.

CHILDREN, Diseases of. Any consideration of children's diseases or, more properly, the diseases of infancy and childhood, should take into account the normal development of the average child. At birth infants weigh about 7½ pounds and are about 21½ inches tall. After a year the weight has usually increased to a little over 21 pounds and the height to about 2½ feet. At 10 years of age most children will weigh about 67 pounds and should be more than 4 feet tall. In normal children the first dentition occurs at 6 months and the closure of the anterior fontanel comes at 18 months. At birth the circumference of a child's head should measure about 13½ inches, which will increase to about 21 inches at 12 years of age. Children may be tall for their age or too short, but this of itself does not indicate disease. Diseases to which children are subject may be divided into at least three groups: (1) diseases which are antenatal or occur in connection with childbirth; (2) diseases peculiar to various epochs in the life of the child; (3) diseases common to adults and children.

Prematurity and Developmental Defects.—A premature infant is one born before the 38th week of intrauterine life. An infant born before the 34th week is not likely to survive. About two per cent of all infants born are premature, and most of them weigh less than 5 pounds. The greater part of the deaths among these infants is due to intracranial hemorrhage. After 48 hours the chance of survival becomes much improved.

Developmental defects during intrauterine life are of two classes, mechanical and chemical. Among mechanical defects are conditions which are usually obvious to the mother and are referred to generally, as deformities. Omitting the class of cases including monsters and joined twins, the deformities most often seen at birth are: lack of symmetry of head and face, harelip and cleft palate, stiffness of joints, wryneck, and clubfoot. The chemical disturbances are usually: lack of minerals in the body, blood dyscrasia, tetany, and endocrine disturbances.

At the moment of birth full expansion of the lungs may fail to take place and what is known as asphyxia neonatorum, associated with cyanosis, may be observed. This is overcome, as a rule, by removal of the cause of the obstruction in the trachea or larynx, by artificial respiration, and by other simple means. If due to a developmental defect of the heart or great vessels (patent foramen ovale, blue baby), mechanical means will be of no avail.

Obstetrical injuries, resulting from such factors as accident, undue use of force, the employment of forceps in delivery, are of frequent occurrence. Among them are hematoma of the scalp, which is not often a serious matter, since it is resolved quickly, and intracranial hemorrhage, which may give rise to grave and unfortunate sequelae, including permanent mental impairment, spastic paralysis, or athetosis. Facial palsy from mechanical injury is usually one-sided and is readily recognized. It is not as serious as it appears, since recovery takes place, as a rule, in two to three weeks. Complete paralysis of the arm attracts attention at once, since the arm hangs limp, but this should not be confused with fracture of the arm or clavicles. It is caused by traction upon the arm in difficult deliveries, which injures the brachial plexus and results in either a temporary or a permanent paralysis.

Pyogenic infections of the newborn infant frequently are encountered, because the child possesses little immunity. The umbilicus is the site most often involved, and what begins as a mild irritation may spread to become an uncontrolled case of sepsis or erysipelas, ending in death. Other parts of the skin are also subject to infections such as impetigo and pemphigus, indicated by large watery or purulent blotches and due to a staphylococcus infection. Such ailments, which would appear to be of little danger to an adult, may threaten the life of a weak and poorly nourished infant; statistics indicate a high mortality among all infants considered as a group.

Jaundice of the newborn may be simple, infectious, or a variety known as icterus gravis. The simple form is rectified in two weeks at most. Infectious jaundice is sometimes associated with a skin or umbilical infection. Icterus gravis is familial. As time passes, the jaundice increases, the color of the skin deepens, and the picture of hemolytic anemia is present. Blood transfusions have been reported as successful, if the blood is suitable, that is, if it is not destroyed by antibodies from the mother and present in the infant's circulation.

Other infections of the newborn are ophthalmia, now becoming rare through efficient prophylaxis, and hemorrhage from the umbilicus or gastrointestinal tract. This last may accompany an infectious diarrhea of young infants, caused by contact with an adult carrier, the agent being salmonella or a virus. It is said to be present in about 15 per cent of all infants.

Other diseases, not always classed as infectious, are rather conditions due to some physical cause, such as dehydration, ileus, intussusception, and interference with urinary output.

Diseases of nutrition are very frequent in the early weeks of life. Vomiting is the commonest and perhaps the most frequent symptom of many disorders. It may indicate overdistension, improper feeding formulas, especially those with excess fats, obstruction of the pyloric opening of the stomach, intestinal obstruction, or the begin-

ning of some infectious disease. Diarrhea is quite common among artificially fed infants. The stools are good indicators of the cause. If vomiting and diarrhea continue too long, acidosis may result.

Among the causes of infant morbidity the lack of vitamins holds a high place. These conditions have both specific and general symptoms. If due to lack of vitamin A (avitaminosis A), beside dryness and scaliness of the skin, night blindness may be present. If from lack of vitamin B (thiamin) the symptoms noted may be meningeal, with convulsions, or there may be manifestation of polyneuritis (beriberi). Lack of vitamin C leads to scurvy, while, if nicotinic acid is not present in the diet, a dermatitis, associated with sore tongue and general malaise, may be observed (pellagra). Lack of riboflavin produces a stomatitis with loss of weight. Loss of vitamin D affects metabolism, especially calcium and phosphorus, and causes bone changes (rickets). Lack of calcium also is responsible for the appearance of tetany and osteomalacia. All these manifestations can be prevented, if the child receives proper amounts of cod-liver oil, thiamin, fruit juices, ascorbic acid, vitamin D, nicotinic acid, calcium, and sunlight. What cannot be supplied from the diet must be given in food or in glucose solutions. In all cases of apparent malnutrition a 10 per cent decrease from the normal standard of height and weight should be a dependable guide when associated with flabby muscles, pallor, nervousness, and digestive disturbances. If these conditions are present, a search should be made for the cause, and the absence of at least some of the vitamins should be assumed.

Digestive Disorders.—The cause of digestive disorders should not be confused with manifestations of disease. These conditions may be induced by underfeeding (either too small an amount or too poor a quality of food) or by overfeeding. Indigestion from protein foods is not usually an important cause, since both carbohydrate indigestion, and especially that due to an excess of fat, are much more frequent. Stomatitis, or inflammation of the mouth, may arise from chemicals or from extreme heat, or may be due to a virus infection. If ulcerative in character, this may be a specific infection. Gangrenous stomatitis (noma) is seen in extremely debilitated children and may commence as a small slough, which spreads rapidly, sometimes destroying the greater part of one side of the face. Some cases of mouth inflammation are due to a parasitic fungus, *Oidium albicans* (thrush).

A child's teeth are subject to many malformations, including supernumerary teeth and total or partial absence of teeth. Defects in the enamel are frequent and may be marked by underdevelopment or by spotting. These defects may indicate a lack of calcium in the diet.

Children are especially liable to acute pharyngeal and tonsillar disease and to retropharyngeal and peritonsillar abscess, which may cause difficulty in breathing. Ludwig's angina is a serious purulent, and sometimes gangrenous, infection of the submaxillary area in the neck. Such ailments require surgical intervention, as a rule, and this should be rendered promptly, since they may threaten life. Occasionally is observed disease of the esophagus, which may be due to a fistulous connection with the trachea or a bronchus. Spasm of the esophagus is more common (cardiospasm) and may be marked by disturbing symp-

toms. Regurgitation of food with swallowing of the regurgitated material will suggest the diagnosis. Children often swallow corrosive poisons such as lye. If recovery occurs, an esophageal stricture may result, calling for early and continuous treatment by dilatation. A foreign body lodged in the esophagus, if it cannot be swallowed nor regurgitated, must be removed through the esophagoscope.

The stomach in children may be: (1) malformed, (2) associated with pyloric stenosis, (3) transposed with the viscera, (4) lodged in the thorax (due to diaphragmatic hernia, sometimes called "upside down stomach"), (5) the seat of tumor such as sarcoma. Projectile vomiting is a symptom of pyloric stenosis, while recurrent vomiting indicates a nervous reaction and may be due to extreme fatigue or excitement. Acute gastritis is not at all unusual in children and is commoner than in adults. Due usually to food or chemical poisoning, it may be associated with acute diarrhea. In improperly fed children chronic gastritis may develop, but this is unusual in older children. Gastric ulcer is rare in children of any age, but gastric hemorrhage is seen frequently and may proceed from a multitude of causes. Very young children often swallow foreign bodies, such as buttons, coins, nails, lead toys, and glass. Most of these pass from the stomach to the intestine within a few days at most. If a foreign body remains in the stomach more than a week or 10 days, it may require surgical removal.

Intestinal obstruction may arise from fecal impaction, malformations, and infections such as peritonitis. Telescoping of the intestine (intussusception) and twists of the intestine (volvulus) are fairly common in infants and have a high mortality.

Appendicitis is seen rarely in children under four years of age, but, if present in any child, should admit no delay in operation.

What is known as celiac disease is seen occasionally in children in the second and third year. It is a chronic intestinal complaint characterized by fatty stools having a foul odor.

Intestinal parasites are of frequent occurrence. These are generally pinworms, roundworms, and tapeworms. They are merely infestations and do not cause disease, but are accompanied by symptoms. The only serious infection by a parasite likely to be encountered is trichinosis, which is due to eating uncooked or insufficiently cooked pork. It is a dangerous and painful disease for which no cure has been found.

Dilatation of the colon (megacolon, Hirschsprung's disease) is a functional disorder with swelled abdomen, constipation, and colic. The bowels sometimes are not evacuated for more than a week, unless enemas are employed.

Rectal disease in children is usually due to anal atresia and anal occlusion. Passage of the feces is difficult in the former and in the latter is impossible without operation. In female children there is sometimes a passage from the rectum into the vagina. Such a condition can be cured only by a plastic operation. Prolapse of the rectum, in which the organ is inverted and protrudes, is usually controlled by replacement and by the use of nonsurgical measures.

Other digestive organs which are the seat of disease are the liver (cysts, abscess), the umbilicus (hernia), the gall bladder and its ducts (infectious jaundice), the peritoneum (peritonitis, ascites from tuberculosis), the groin (inguinal

hernia). In young infants a hernia sometimes will disappear, if a yarn truss, a spring truss, or an abdominal binder be used continuously for a considerable period. Diaphragmatic hernia has been mentioned under remarks concerning the stomach.

Diseases of Metabolism.—For the most part these are best regarded as disorders. Two common ailments of children are acidosis and alkalosis. Acidosis is a disturbance of the normal acid-base balance with excess acid in the blood. It produces dyspnea, asthma, drowsiness, and vomiting. Occasionally an attack may indicate the presence of diabetes, hitherto unsuspected. The symptoms of alkalosis are less pronounced, but extreme weakness and lethargy are present. Tetany is sometimes observed.

Cyclic vomiting is confined almost exclusively to the period of childhood and is apt to make its appearance before the age of two. It runs in families and is seen generally in nervous, high-strung individuals. The attack appears suddenly with incessant vomiting, drowsiness, high fever, and sometimes is followed by a period of coma. The condition may give rise to alarm, since it may continue for at least a week. Little is known of the cause, but the attacks disappear usually as the age of adolescence approaches.

Diabetes mellitus is seldom present in the extremely young, but is of frequent occurrence in children five to ten years old. The onset is usually abrupt, much more so than in adults, and extreme thirst and enuresis (bed-wetting) developing within a week or two should arouse suspicion. The most important complication of diabetes in children is coma, which may be an early symptom. Other complications of the disease, so often encountered in adults, are generally absent. The outlook for recovery, before the discovery of insulin, was practically hopeless and life was seldom prolonged for more than three or four years. At present the prognosis is as good as in adults. Diabetic children require insulin in practically all cases.

Other metabolic disturbances due to an abnormality in chemical function of the body are: albinism, urinary disorder (such as cystinuria), and lipid deposits in various portions of the body (Gaucher's disease, Niemann-Pick disease).

What is called the Schüller-Christian syndrome also occurs in children up to eight years of age. This is a necrotic bone disease of the skull, the larger flat bones, and sometimes the long bones, with accompanying diabetes insipidus.

Diseases of the Urogenital System.—Diseases of the urinary tract differ little from those affecting adults; but, since the symptoms are often less easily interpreted, urinary examinations are of great importance.

Albuminuria, in the presence of high fever due to respiratory disease, is quite common and does not necessarily indicate any serious damage to the kidney. That associated with scarlet fever may indicate a nephritis. Sometimes a persistent albuminuria may prove to be merely functional and disappears in time.

The various types of renal disease seen in children are much the same as those found in adults. (See KIDNEY.) Tumor of the kidney or adrenals is often sarcoma or lymphosarcoma and may exist in newborn infants. Surgical removal is sometimes successful.

Bladder and genital malformations are occasionally observed. Exstrophy of the bladder

(externally situated bladder), defects of the urethra (hypospadias and epispadias), undescended testicle and hermaphroditism in males, atresia of the vulva and imperforate hymen in females are the commonest developmental defects. Girls are especially liable to nonspecific vaginitis or to epidemic gonococcus vaginitis.

Respiratory Disorders.—Nosebleed is of common occurrence in children, but is seen seldom in infants. It may mark the onset of infectious disease.

Acute rhinitis is present in children in much the same form as in adults. Allergic rhinitis (hay fever) is sometimes continuous instead of seasonal and may be due to various irritating substances other than the pollens.

Otitis media (middle ear disease) is a complaint to which children are particularly prone and in young infants sometimes will be suggested by the symptoms of rolling of the head and of putting the hands to the head, in cases of those too young to talk. Mastoid disease is now seldom seen in otitis media properly treated.

Croup is a term used to designate the choking spasm observed in young children with acute laryngitis, laryngeal stridor, and laryngeal spasm, occasionally in diphtheria.

Acute bronchitis is particularly common in younger children and, while it may resolve itself in a week, the disease may continue into bronchopneumonia in the feeble and undernourished, who have a poor outlook for recovery. Chronic bronchitis is seen oftener than is generally supposed and may be due to untreated tonsillar infection or to adenoids. It is apt to be worse in winter.

Foreign bodies lodged in the bronchi frequently are reported and often are in the news, since their removal is now achieved by the use of the bronchoscope. They are evacuated by coughing in only a small percentage of cases (from 4 to 5 per cent).

Asthma in children may be due to allergy or may be associated with other diseases.

Lobar pneumonia is common to all ages. It has a sudden onset, frequently with vomiting, and is occasionally confused with appendicitis. Clinically it does not differ from the disease present in older persons. A frequent complication is empyema or pus in the pleural cavity. The mortality in pneumonia under modern methods of treatment is probably not over 5 per cent in children.

Tuberculosis of the chest may be intrathoracic and may involve the mediastinal glands only. In children the disease has infinite variety and should be considered as an infection of a general and not a selective character. The cause is in the tubercle bacillus, which may involve any part of the body. Ordinarily the avenue of infection is the respiratory tract, but the bovine type may be acquired through ingesting milk from infected animals, which leads usually to abdominal tuberculosis. Recovery from this type is frequent. Contact with tuberculous adults is generally the manner in which children acquire the disease. In addition to the disease seen in the respiratory organs and in the peritoneal cavity, miliary tuberculosis, an acute variety, occurs. In obscure cases tuberculosis is sometimes difficult of diagnosis. X-ray films of the chest are of great value in detecting early cases.

Heart Disease.—Congenital disease of the heart is generally evident soon after birth and this variety accounts for about 2 per cent of all

cases of heart disease in children. In the more serious cases many infants die soon after birth. Causes include narrowing of the aorta or of the pulmonary artery and defects of the heart wall (open foramen).

Functional heart disturbances occur in children as in adults. These are principally: fatigue syndrome, arrhythmia, rapid heart, slow heart, flutter, fibrillation, and heart block.

Of the infectious diseases of the heart in children, rheumatic heart disease is one of the commonest and most serious. The term rheumatic is not strictly accurate, but is used to cover a multitude of symptoms and evidences of disease, such as neuralgias, sciaticas, back and joint aches, and generalized bodily and muscle pains seen in childhood. The rheumatic heart is rare before the age of 5 and becomes less common after the age of 10. Many of these cases are associated with tonsillitis and with recurring acute attacks of sore throat. There are intervals when the child appears well and at first the heart lesion may be overlooked entirely.

Heart disease is also associated with polyarthritis and chorea. The causal agent may be a variety of the streptococcus, but this cannot always be demonstrated.

The symptoms of cardiac disease are apt to be vague, but loss of weight, pallor, anemia, and breathlessness may arouse suspicion and lead to an examination of the heart. After an acute attack the heart may become normal, if no further symptoms appear and the cause is perhaps removed; or it may be permanently damaged, leading to valvular incompetency in later life. The outlook is by no means entirely bad.

Diseases of the Blood.—Nutritional anemia, in which the hemoglobin is as low as 30 per cent, is sometimes seen. This is due to lack of iron plus a lack of vitamin content in the food, which is manifested by rickets. Scurvy (avitaminosis C) is also accompanied by anemia. Aplastic anemia with a low red cell count may be due to acute or chronic infectious disease. The cause is often undetermined and the prognosis generally is unfavorable. Other anemias, seen also in adults, are Mediterranean (Cooley's), and a familial hemolytic variety known as sickle cell anemia. Many anemias in children are secondary to some acute or chronic disease or intoxication. Among these are diphtheria, pyelitis, and rheumatism. A frequent cause of anemia is hemorrhage, such as that following a tonsillectomy, or from hemophilia or purpura. Leukemia may be seen at any age and is not a rarity. Hemophilia is a hereditary disorder associated with prolonged bleeding from even a slight wound. The disease is manifested only in males, but is transmitted in the female line. Purpura is a condition in which spontaneous hemorrhages occur in the skin and in mucous membranes. It is usually a symptom of some disturbance of body chemistry and is observed in toxemia, anemia, or allergy. Some varieties bear the names of individuals who have brought them into special notice (Henoch's purpura). Hodgkin's disease in children is no different from that seen in adults.

Diseases of the Endocrine System.—See ENDOCRINE GLANDS; ADRENALS; CRETINISM; GOITER; MYXEDEMA; PITUITARY BODY; THYROID GLAND.

Diseases of the Bones, Muscles, and Joints; Locomotor System.—In children the differentiation of what are often called growing pains from

muscle and joint affections is not always appreciated. Some of these are due to changes in climate, others are fatigue pains, while still others indicate definite disease. In children over three years, if the pains in the limbs are accompanied by fever, if the joints are tender, or if the skin over these is reddened, the diagnosis of rheumatic fever should be suspected. Occasionally a case of acute osteomyelitis will be confused with rheumatism, but here the symptoms are usually localized in or about one joint.

Rheumatoid arthritis in children is not as common as in adults, but, if present, is manifested by great distortion of the joints of the hands and feet.

Achondroplasia is a joint disease in which shortening of the limbs and stubbiness of fingers and toes is pronounced. It has the appearance of dwarfism. The head is usually enlarged.

Other diseases of the same nature are fragile-bone disease, marble-bone disease, spider fingers, and skull deformities.

Spinal curvature is usually a postural disease or is due to infantile paralysis.

Muscular defects, atrophy or dystrophy, are sometimes congenital. Wryneck generally is congenital and only occasionally is acquired.

Diseases of the Nervous System.—Various forms of meningitis, while infectious, find their place here. Infants are especially liable to a basal posterior meningitis, while the epidemic cerebrospinal variety affects older children. In many cases permanent injury to the nervous system occurs, in some cases recovery may result. Tuberculous meningitis is invariably fatal.

Hydrocephalus is an enlargement of the head accompanying excessive accumulation of cerebrospinal fluid within the skull. The diagnosis is usually obvious. Little success has been achieved in the treatment of this condition.

Brain tumors in children are no different in character from those found in the adult.

Spastic paraplegia is often caused by intracranial hemorrhage with serious damage to the brain cells.

Infantile paralysis is an acute infection of the brain and spinal cord due to a virus, as yet unseen. It attacks children from the second to the sixth year most frequently. (See POLIOMYELITIS.)

Chorea, or St. Vitus's dance is characterized by involuntary movements and emotional disturbance. It is seen generally in children over five years old and its pathology is uncertain. The disease often is accompanied by heart disease. Recovery from chorea is the rule.

There are a number of other diseases of the nervous system which are organic, such as cerebral degeneration, various forms of ataxia (staggering), and a few diseases of the muscles, details of which are omitted here.

Infectious Diseases.—While children may be affected by almost all diseases encountered in adults, there are a few which deserve special mention, if only as reminders of their frequency among the young.

Diphtheria is still a serious disease of children, especially in isolated localities. It is essentially a disease of the young, is diagnosed bacteriologically, and is treated successfully by antitoxin. Nevertheless, it still enjoys a high mortality rate in some areas.

Scarlet fever is a local throat infection with severe toxic effects on the body. It is caused by

the *Streptococcus scarlatinae*. Its virulence has declined in the 20th century due to a number of factors.

Measles is one of the most infectious of the exanthemata and is due to a virus. It is common between the ages of two and seven and in some epidemics it runs rampant through a community.

Whooping cough is almost entirely a disease of childhood and the diagnosis is easily made. It has serious lung complications and may end in bronchopneumonia and death, in very young and weakened children. It runs a long course in the average case and is not to be considered lightly.

Chicken pox is a mild disease usually, but has been mistaken for smallpox.

Smallpox occurs in a severe (hemorrhagic) and in a mild form. In the 20th century it is found only in sporadic form in the United States and in countries where compulsory vaccination is not in force.

Mumps is seen frequently in children and is regarded generally as a children's disease, but is not at all infrequent in adults. It has a long incubation period and is sometimes undetected at first, because the characteristic symptoms may not be manifested always in the region of the parotid gland. It may have complications, especially in the testicle.

Typhoid and paratyphoid fevers, once common in children and an important factor in mortality, are now much less frequent due to improved public health inspections of food and water supply and to antityphoid vaccination.

Tetanus, rabies, and brucellosis (undulant fever) are diseases to which children are sometimes exposed.

Syphilis in children is generally the result of infection before birth. Such cases do not exhibit the primary stage and manifest the disease in full-blown form.

Diseases of the Skin.—Only the common diseases of the skin are mentioned here.

Perhaps the most troublesome is eczema, a dermatitis of infectious or noninfectious origin. The ailment appears usually after the third month. At first the rash is only a redness of the skin, but later it becomes a generalized patchy eruption with intense itching. Secondary infection of the skin is the rule and in neglected cases the body is covered with pustules, scales, and cracks. It is often resistant to treatment.

Nettle rash or hives (urticaria) is common and may be due to digestive disturbance or allergy.

Psoriasis is seen generally in older children and is a chronic, nonitching disease occurring in patches. The patches are scaly and the skin somewhat thickened. The cause is unknown and the psoriasis may persist at intervals through life.

Impetigo is a contagious skin disease of the streptococcal or staphylococcal origin, difficult of treatment.

Herpes of the lips and other parts of the body is common and may exist as herpes zoster (shingles).

Dermatophytoses, scabies, ringworm, and warts are particularly common. Warts are not contagious.

Miscellaneous Diseases and Common Conditions.—Children have a much less stable nervous system than that of adults. Consequently a great many behaviorisms exist. The nervous energy of a young child is out of all proportion

to its size and, if it finds no proper and legitimate outlet, will be thrown out of balance, so to speak. The result is the development of many abnormalities of conduct. Uncorrected actions become fixed habits. Moreover, the sense of fear existing in the minds of many children may have unfortunate manifestations. Among the many functional nervous disorders, all of which are characterized by one or more prominent symptoms, usually obvious, are the following.

Rolling the head and banging the head are two rather similar habits exhibited in young infants. There is no evidence that the child derives any pleasure by it and in many cases it causes pain and sometimes bruising. It is sometimes caused by teething or by earache, but more often there is no assignable cause.

Thumb-sucking is almost universal and thumb- or finger-sucking may persist for several years, if the habit is not broken. There is no evidence that this habit produces any appreciable change in tooth development.

Head-nodding is a rare condition, often associated with nystagmus of the eyes, and recovery from it usually is made in a few weeks.

Refusal of food in young children and habits of slow eating in older ones are annoying to parents, who are sometimes even alarmed over it. These peculiarities result from faulty management in early life. If parents or others show anxiety or irritation, refusal to eat normally may be persistent because of the notice which it receives, and this in turn fosters the child's egoism. Attempts to placate the child by offering other and more palatable food are worse than useless as corrective measures.

Holding food in the mouth (and refusal to swallow it) or expectorating food are also irritating habits, generally susceptible of correction by good management.

Nervous starvation is more serious, is seen in older children, who refuse to eat, and may be attended by great loss of weight. This is actually a psychosis and may be difficult to treat successfully.

Biting the nails is an unpleasant habit observed in nervous children and often is induced by observing adults who have never outgrown it. If it is allowed to persist, it will pose a difficult problem later in life.

Dirt eating (pica) is not common and is due to a morbid craving for articles like hair, paper, earth, coal. It causes chronic indigestion and foul stools, and the child is apt to exhibit nervous fits and outbursts of temper.

Disturbances of sleep, refusal to go to sleep or to stay in bed, and occasionally sleepwalking are among the common problems which confront the average parent. Underfeeding, overfeeding, and indigestion are basic causes. Bad or irregular sleeping habits and fear of the dark play their part. Rather common in younger children is nightmare (night terror), which not infrequently is due to some disturbing factor of the day, for the child lives over the incident in distorted form. True sleepwalking (somnambulism) is somewhat rare.

Delay in talking is a speech disorder, which worries parents who sometimes fear that their child is mentally deficient. This may be of no moment, but it may also be due to deafness, especially partial deafness. If entirely deaf, the child will of course be a mute. Mental retardation is also the cause in some cases.

Stuttering is an incoordination of the muscles used in speech. It is more frequent in boys than in girls and is made worse by nervousness and by mimicry on the part of other children. If it cannot be overcome by educational methods, it may persist through life.

Habit spasm is a disorder often encountered. It may take such forms as blinking, grimacing, head tossing, or aimless movements of the arm. It may last for months or even years, or it may become permanent. Curiously, if one habit spasm is overcome, another may take its place. The habit spasm of adults, though generally thought to be organic, is actually the persistence of a purposeless movement begun in childhood.

Bed wetting (enuresis) is almost universal and is a cause of much worry to parents. It is generally confined to the hours of sleep. Bed wetting should not normally continue much after the age of two, but no set age for it to cease can be determined. A variety of causes besides the continuance of the normal incontinence of infants may cause bed wetting. Certain diseases are sometimes responsible, and if persistent efforts do not eliminate the habit, a careful physical examination is indicated. In this connection it should be mentioned that many parents consider bed wetting in children up to the age of five a normal situation, which is far from true.

Incontinence of the bowels may indicate mental disorder or an organic disease. It occurs generally during the day. Sometimes it is due to mismanagement, but if it does not cease, the cause should be ascertained and medical advice sought.

Other disturbances pertaining especially to children are tongue-tie, which is not particularly common, and minor illnesses and fever associated with teething.

Convulsions may occur at any age, but are more frequent in young infants than in older children. They may indicate disease but are themselves a group of symptoms. Sometimes they are due to a true epilepsy which has now become manifest, but in the great majority of cases they arise from some other cause. Onset is abrupt, the eyes close, the limbs twitch, the tongue may be bitten, evacuation of the bowels may occur, consciousness is lost, and the child does not cry. In some cases convulsions are an indication of mental deterioration or intracranial disease. Death seldom occurs in the acute attack. The usual domestic remedy is immersion in a tub of warm water until a physician can be summoned. Crying convulsions sometimes are mistaken for true convulsive seizures, although the two are dissimilar. The former occurs after a fit of temper: the child holds his breath until cyanosis is apparent and asphyxia begins, after which he takes a full breath and, obtaining relief, becomes quiet. Spoiled children frequently indulge in this sort of fit. The disturbance may recur at intervals, but it disappears when the child is older.

Vulvovaginitis of young girls is not uncommon and is apt to be horrifying to parents. Lack of cleanliness may be the cause and the trouble may be rectified within a few days by the use of simple measures. In all purulent cases, however, a bacteriological examination is indicated to ascertain whether the gonococcus is present. If so, the disease may be due to contact with infected agents, such as adults, linen, or towels.

The disease is highly infectious and prompt treatment with penicillin is mandatory.

Phimosis, or narrowing of the prepuce, is common in male infants. It seldom interferes with the passage of urine, but it may cause irritation from lack of cleanliness. Circumcision is advised by many obstetricians as a routine practice.

Miscellaneous Emergencies Affecting Children.—In infants and in young children many conditions arise which are alarming to parents. Some of these are of no great consequence, while others are of serious import. In the case of a very young child, who cannot evaluate or describe his symptoms, it may be necessary to make a tentative diagnosis by observation. Moreover, the mother may often furnish information of value to the physician which he may not be able to obtain himself.

A few fundamental facts are of importance in examining the physical and mental condition of children. These include the following: A very sick child is generally listless and does not resist handling nor does he scream. If he lies in a peculiar position, this is because he finds it more comfortable to do so. If he does not move a limb freely, there is probably something the matter with it. If he vomits, the cause may be not something he has eaten, but the onset of some acute febrile disease. If he limps, a disease of the hip, knee, or leg bones may be responsible. If he puts his hand to his head, this may be a sign of middle-ear inflammation. Such examples can be multiplied many times. The most important thing for the physician to know is: What does the child do that he did not do formerly and what does he fail to do that he is used to doing?

Among acute emergencies affecting young children which must be dealt with without delay are pyloric stenosis, swallowed foreign bodies, convulsions, intestinal obstruction, obstruction of the larynx caused by inhaled foreign bodies, rectal obstruction and anal obstruction caused by impacted feces, and fractures. Some of these emergencies can be handled on the spot by using simple remedial action; others may require surgical intervention.

Other disorders which parents may note by continuous observation are epilepsy, the presence of intestinal parasites, congenital dislocation of the hip, muscular dystrophies, tuberculosis of the spine, lateral curvature of the spine, and tuberculosis of the hip or knee joint.

Even physicians may miss osteomyelitis of a leg bone and instead make a diagnosis of rheumatism. As a rule, such a diagnosis should not be regarded as final until the presence of an infectious bone or joint disease can be ruled out. Chronic pain in the knee or hip with spasm of the muscles will suggest tuberculosis of the joint involved. Fractures in children following a fall are sometimes overlooked. An injury to the elbow, for example, may be regarded as a sprain when it is in reality a condylar fracture. Any deformity or undue swelling of the arm, wrist, elbow, or other bony structure following violence should warrant a provisional diagnosis of fracture, which in children is often incomplete (greenstick fracture).

Intestinal obstruction is a serious emergency in young children. The outstanding symptoms are abdominal pain; vomiting; a swollen, drum-like abdomen; and, sometimes, the appearance of

a localized abdominal tumor. Impacted feces will cause symptoms of mild obstruction, but this condition can be relieved by administering an enema, or by the manual removal of the ball of feces, a procedure which will usually require brief etherization.

The accidental inhalation of a foreign body, such as an orange seed, which may be sucked into the larynx, can generally be relieved by holding the child upside down by the legs and slapping his back. If action is delayed and the foreign body is taken into a bronchus, surgical removal may be required. Swallowed foreign bodies should not cause immediate alarm, since they are generally expelled through the intestinal canal within a few days. If any doubt exists as to their whereabouts, X-rays will be required.

Convulsions and croup may cause some alarm. Children almost never strangle from croupous attacks, and simple remedies will suffice. Convulsions may have an underlying cause, such as epilepsy, but the simple convulsions of infancy will usually yield to a hot bath until such time as a physician can be summoned. See also PEDIATRICS.

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HAROLD WELLINGTON JONES, M.D.,
Editor, "Blakiston's New Gould Medical Dictionary."

CHILDREN IN THE WOOD, The (also called **THE BABES IN THE WOOD**), an old English ballad found in several collections, including Thomas Percy's *Reliques of Ancient English Poetry* (1765, q.v.). It tells the story of two children whom their uncle wished to murder for their inheritance. He hires two assassins, but one of them, rebelling at killing the children outright, leaves them to die in the woods. The authorship of the ballad is unknown, and the date is uncertain; it appears in the *Stationers' Register* of 1595, and was probably written at about that time. A play by Robert Farrington, published in 1601, has a similar plot, and some critics believe the source of the two to be the same.

CHILDREN OF EARTH, a play of New England life by the novelist Alice Brown (q.v.). In 1913 the theatrical producer Winthrop Ames offered a prize of \$10,000 for the best play by an American author. Manuscripts were to be submitted anonymously. The prize was awarded to Miss Brown for *Children of Earth*, and the play received its first production at the Booth Theatre, New York City, on Jan. 12, 1915. Although the critics hailed its literary and poetic qualities, the play failed of popular appeal. The heroine, who has led the life of a conventional New England spinster, experiences a great love in middle age. Her character and that of her lover are not fully developed, however, and when their New England consciences drive them back into conventionality, the spectator remains unconvinced of the logical reasons for their adventure.

CHILDREN OF GIBION, a novel by Sir Walter Besant (q.v.), published in 1886. It tells the story of two children brought up by a wealthy widow in the West End of London.

One is her own daughter; the other, the child of a slum family of the East End whom she has adopted. When the girls are grown up, they meet this family, and through the presentation of contrasting ways of life the author gives his views on social problems. The novel is well written, and it became very popular. It did much to call attention to the evils of sweatshops and also helped to further the movement to organize women workers in labor unions.

CHILDREN OF THE ABBEY, The, a romance in four volumes by the Irish novelist Regina Maria Roche (q.v.), published in 1798. It recounts the adventures of a motherless girl beset by enemies. Melodramatic and sentimental, the romance suited the taste of the times and became very popular.

CHILDREN OF THE GHETTO, a novel by the English writer Israel Zangwill (q.v.), published in 1892. It is divided into two parts. The first is a masterly account of life among poor Jews in London's East End and of their adherence to the tenets and practices of orthodox Judaism. The second describes those of the next generation who have acquired wealth, and their problems of adjustment to contemporary London life. The novel was dramatized in 1899. Zangwill's sympathetic and well-drawn picture of Jewish society helped to further the Zionist movement, in which he was interested.

CHILDREN OF THE NIGHT, The a collection of poems by Edwin Arlington Robinson (q.v.), published in 1897. It consists of 57 short poems, most of which are complex portraits of various individuals. Robinson's delineation of character is so well done that the reader feels that he knows the person described. Miniver Cheevy, who "loved the Medici," Richard Cory, and the rest are colored by the poet's pessimistic view of life. The poems are sometimes obscure because of their condensation, and the tone is sardonic. *The Children of the Night* was highly praised by Theodore Roosevelt, in the *Outlook*.

CHILDREN OF THE SOIL, a novel by Henryk Sienkiewicz (q.v.), published in Poland in 1894 as *Rodzina Polanieckich*. It tells the story of the marriage of Pan Stanislas Polanietzki and Maryina Plaritska, and of their problems, misunderstandings, and eventual happiness. The novel paints a broad picture of contemporary Polish life. Of particular interest are the glimpses of traditional Polish country life and the treatment of questions of property.

CHILDREN OF THE WORLD, (Ger. *Kinder der Welt*), a novel by Paul Heyse, q.v. (later Paul von Heyse), published in Germany in 1873. The work is the literary echo of the discontent and rebellion against the existing order—political, religious, social, and economic—which, beginning in the universities, spread through Germany in the period between the revolution of 1848 and the Franco-Prussian War. It is a perfect example of the *Tendensroman* (novel of purpose), which such times of unsettled thought and altered values engender. Except in its treatment of women, which is extremely romantic, *Children of the World* is the philosophy of Arthur Schopenhauer and David Friedrich Strauss (qq.v.) reduced to novel form.

CHILDREN'S AID SOCIETY, The, a nonsectarian organization founded in 1853 "to improve the conditions of poor and destitute children in the City of New York and the State of New York." Charles Loring Brace, the founder and first secretary of the society, was particularly fitted for the task. After training for the ministry, he had traveled and studied living conditions in the large cities of Germany, Hungary, England, and Ireland. Returning to New York he worked among the wretched and outcast. After a year's experience among adults in the Five Points, he became convinced that "an effort to reform those old in sin was hopeless." Out of this grew his determination to devote himself to the cause of children.

Mr. Brace's unique contribution to social work was his belief that the best place for a homeless child was in a private family home where he could grow up loved and protected like other children. Looked upon as somewhat revolutionary in their day, his ideas have long since become practice in social work, and out of this philosophy has grown The Children's Aid Society's present foster home work and that of other organizations which stress foster home rather than institutional care.

In 1951 the society was providing 12 essential services for more than 45,000 children of all races and creeds from infancy to 21. These services include foster home care, homemaker service, boys' and girls' clubs on a neighborhood basis, with health examinations and medical supervision, nourishing lunches, dental clinics, individual attention to problems of children, counseling and employment service, psychiatric service, convalescent care, and summer camps.

CHILDREN'S BUREAU, of the Social Security Administration, United States Department of Health, Education, and Welfare, was established by Congress April 9, 1912, to investigate and report "upon all matters pertaining to the welfare of children and child life among all classes of our people." In 1935, under the Social Security Act, the bureau was made responsible for the administration of grants to the states to enable them to extend and improve their services.

After 33 years in the Department of Labor, in 1946 the bureau was transferred to the Federal Security Agency which, in 1953, became the Department of Health, Education, and Welfare.

Under its basic act, the bureau makes studies of conditions that are a hazard to the well-being of children, and of the effectiveness of measures designed to prevent and alleviate such conditions. On request, it gives advisory service to state and local agencies regarding methods of conducting programs aimed at promoting the health and welfare of children. It issues publications for professional and lay use. Four of the bureau's most widely used publications for parents are: *Prenatal Care*; *Infant Care*; *Your Child from One to Six*; *Your Child from Six to Twelve*. In 1954, it released a fifth in this series: *The Adolescent in Your Family*.

Congress has authorized a total of \$41,500,000 in annual grants to be given to the states. Actual appropriations, which are administered by the bureau, totaled \$30,000,000 (fiscal year 1955).

The bureau carries responsibility for recruiting and providing technical help to specialists in children's services sent to other countries by the Foreign Operations Administration, and for de-

veloping programs of study and observation for specialists from other countries coming to the United States. The chief of the Children's Bureau is the United States representative on the executive board of the United Nations Children's Fund.

CHILDREN'S COURTS. See **CHILD WELFARE.**

CHILDREN'S CRUSADE, The, a singular movement in 1212, preached in France by Stephen, a peasant boy, and in Germany the same year by Nicholas, also a peasant boy. Some 90,000 children left their mothers and schoolmasters in the spring "to rescue the Holy Land from the infidels," and ships were placed at their disposal. The French contingent embarked at Marseilles in August; part perished the same month by shipwreck on the island of San Pietro, and the rest were sold into slavery to Mohammedans. The German contingent reached Genoa in August, and was utterly dispersed by various disasters before the next spring. See also **CRUSADES.**

CHILDREN'S LITERATURE. In its usually accepted sense, children's literature includes only that literature intended for the entertainment or instruction of children. In its wider and truer sense, it embraces all literature marked by simplicity and vividness of expression and that piquantly imaginative quality demanded by young minds. That portion of the world's great literature having these characteristics has been taken over bodily by the children. Folklore and fables, such as Aesop's *Fables*, romantic adventure, as in *Arabian Nights*, and the whimsical creations of great writers, such as Jonathan Swift's *Gulliver's Travels*, Daniel Defoe's *Robinson Crusoe*, and Washington Irving's *Rip Van Winkle*, possess these qualities and have been accepted by the children.

Notwithstanding the fact that children's literature is not separated from adult literature by any clearly defined partition, it is possible to trace its origin and growth backward from the present products to their sources, and thereby show a continuity of characteristics which mark children's literature as such.

Through all recorded history children have taken to themselves the folk tales, many of the ballads, the legends and myths, the tales of magic and knighthood, the adventure and exploration, the jingles, part of the lyrical poetry, and the epics.

History reveals four—fairly distinct periods that have contributed to the present diversified field of children's books, although, as periods, they have no exact beginning or ending, but, rather overlap and merge imperceptibly. First came the ancient precepts, tales, and poems chiseled on stone, clay or brick tablets, followed by, or used concurrently with, papyrus rolls (strips made from tough water plants). Next came the age of compilation in medieval times, when monks collected the ancient works and recopied them upon parchment or vellum, adding current tales and poems. The third period was inaugurated with the discovery of the printing press and its spread to all countries, widely disseminating the literature of all lands and revealing, incidentally, that the folklore that had entertained children in separate countries was essen-

tially the same material, differing in versions only. The fourth period is the modern age, which may be called the consciously experimental period, when, for the first time, children's own interests are studied to determine what forms of literature give them most pleasure and instruction, and to devise new forms suited to individual interests.

ANCIENT PERIOD

Egypt.—The oldest manuscript yet discovered that addresses words directly to children comes from the banks of the Nile, and was a production of Ancient Egypt. It is *The Precepts of Ptah-hetep*, contained in a papyrus roll now preserved in the Bibliothèque Nationale at Paris. Although this papyrus was written around 2600 B.C., it is a compendium of much older precepts dating back to, or even beyond, 3850 B.C. This book, lofty in tone and style, with a viewpoint toward life that is highly civilized even according to modern standards, contains advice for the young: "Be not puffed up with your own knowledge, but honor the truly wise. Nor shall you fail to honor even the simple . . . A good son is a gift of the gods. Such a son does more than is demanded of him and seeks to please the soul of his father, and strives to increase his strength through righteousness . . ."

The earliest manuscripts, so far exhumed, contained mostly precepts and advice, but it was not long before the current folk tales were likewise recorded. The earliest known manuscript of fictional stories is contained in what is known as the Westcar Papyrus, written about 2800 B.C., and preserved for modern scholars in the Berlin Museum. It, too, is from early Egyptian literature, and consists of narratives supposedly told to his sons by King Khufu, or Cheops, builder of the Great Pyramids. Like the majority of Egyptian literature, it deals with magic and the dramatic acts of gods and magicians. The Egyptians were lovers of these tales of magicians, filled with stories of animals that talk and who, in their human personifications, reveal the whimsies of human nature.

Typical of early Egyptian tales is a story called *The Shipwrecked Sailor*, dated about 2500 B.C. and now preserved in Russia. A forerunner of *Robinson Crusoe* and *Swiss Family Robinson* (q.v.) it tells of a shipwrecked vessel from which one lone survivor reaches the Isle of Plenty, where, with a talking serpent as his companion, he lives by his own resources on the abundance of nature.

Babylonia and Assyria.—Babylonia, both before and after it was conquered by the Assyrians, was rich in stories and poems that form a source for later children's writers. Accounts found on burnt brick and baked clay tablets have been uncovered dating back to 2000 B.C., although the golden age of Babylonian literature was from about 668 to 608, when the ruler, Sardanapalus (q.v.) gathered a remarkable library at Nineveh, collecting the ancient papyrus and tablets and having them translated. Typical of early Babylonian tales was one of a serpent who complained to the sun that the eagle had devoured all her young. The sun advised the serpent to ensnare the eagle by means of a dead ox as bait, but the wise eagle escaped the snare.

Greece.—*Homer.*—On library shelves for modern children are many titles such as *The Children's Homer*, *The Iliad for Boys and Girls*, *The Odyssey for Boys and Girls*, and various

adaptations of the Homeric legends. All of these spring from the same source, the two great epic poems of ancient Greece, the work of the master storyteller, Homer.

Tradition pictures Homer as a blind poet wandering from town to town reciting his narrative of gods and men, but history has not yet authenticated either the time nor the personality of the man. His great books come from an age before literary history, put by some as early as 1159 B.C., by others as late as 685 B.C. The legend of his blindness may have arisen from the known fact that certain rulers in ancient days blinded their favorite bards so that they might not wander away to other places. Seven different cities have claimed Homer as native son; however, by the time the Greek historians of the 5th and 4th centuries B.C. began to investigate origins and study documents on the Homeric epics, the man himself was already a legend.

No matter what or who the great author known as Homer truly was, the characters he created and the scenes he depicted form a basic part of children's literature. The theme of the *Iliad* (q.v.) is the final incident in the siege of Troy by the Greeks, and a large part of Greek mythology is revealed in the poem. The *Odyssey* (q.v.) concludes the story of the siege of Troy, with the dramatic trick of the wooden horse, and recounts the adventures of Ulysses (called Odysseus in Greek) on his way home, together with the experiences of his wife, Penelope, while awaiting him.

Aesop.—The second Greek of primary importance in children's literature is the slave, Aesop (c.620-560 B.C.). Aesop's name has been given to a whole class of animal tales told to point up a moral. He did not originate all the fables attributed to him, nor did he originate the form, since fables are found in early Egyptian literature, but he brought to the fable a dramatic liveliness that children enjoy. He may not even have committed his fables to writing; the earliest record is of a collection of ten books of Aesop's *Fables* made by Demetrius of Phalerum (345?-283 B.C.), but this collection was not preserved. The Latin translations are the ones familiar today, the best known of which is the collection of Maximus Planudes, a monk of the 14th century, in whose edition are added many tales from Oriental sources. Aesop, although once a slave of Iadmon of Samos, must have been freed, since he once conducted a public defense of a citizen. He used fables to persuade and instruct as well as to entertain; he created laughter in order to reprove and admonish. (See also **FABLES OF AESOP.**)

Greek Historians.—Not only did Greece give to children's literature the first great epics and fables, but it also gave the first great history. History—one of the primary fields of children's reading interests—may only develop late in a nation's life, after centuries of recorded national experience have built a unified flow of personalities and activities. The higher a nation's civilization, the greater its recorded history. Ancient Greece achieved an unprecedented height, and of its men and women of genius in the 5th century B.C., Herodotus and Thucydides were the greatest historians, not only of their time but of all time.

Herodotus.—Herodotus (c.484-424 B.C.) wrote one great work upon which much children's literature has been based, both in exact translations and adapted forms. This was his *Histories*, a

narrative account of the wars waged by the Persians against the Greeks.

Thucydides.—Thucydides (c.454–399 B.C.), the first wandering war correspondent, wrote a *History of the Peloponnesian War*, a work remarkable for the fidelity and exactness of its details. He began the personal observation, factual narrative that flowered in the 20th century.

Xenophon.—Xenophon (c.434–355 B.C.) followed Thucydides, continuing, with his *Hellenica*, a history of the Greeks, from the point where Thucydides left off, and adding the *Anabasis* (q.v.), an account of the expedition of Cyrus, which has become the first text in Greek given to modern students.

Plutarch.—Plutarch (c.46–c.125 A.D.) was a biographer, the first to write biography in a narrative form that children could appreciate. He accumulated, from travels in Egypt, vast stores of historical and mythological lore, and examined public and private documents in Greece and Rome. From this material he wrote his *Parallel Lives*, character studies of illustrious Greeks and Romans in pairs: Demosthenes and Cicero, Alcibiades, and Coriolanus. There were in all fifty lives of which 14 have been lost; from those remaining, dramatists and writers, including Shakespeare, have drawn copiously for material.

India.—*Sutta-Pitaka*.—India possessed a written literature before 2000 B.C., but much of it was written on palm leaves and could not be preserved. Copies were made of some small part of it, however, before it crumbled to dust. The first work that forms a readily observable source of children's literature is the *Sutta-Pitaka*. The *Sutta-Pitaka* tales are embodied in one of the *Three Pitakas* or *Baskets*. (See also *PITAKA*.) They are stories accumulated around the few known utterances of Gautama Buddha (563?–483 B.C.).

Written between 300 and 500 B.C., the *Sutta-Pitaka* contains the Buddhist birth stories (Buddha was supposedly reborn many times) called the *Jatakas* (q.v.). A *Jataka* is a Buddhist birth story, or a legend or fable supposedly told by Buddha to illustrate an ethical lesson. In reality, the *Jatakas* are the accumulated folklore of unknown generations of Indian storytellers, happily gathered together in one volume of legends, jungle lore, and fables. It was to be known under many names in the centuries that followed: *The Book of Five Hundred and Fifty Jatakas*, and in an even more popular version, *The Panchatantra* (q.v.) or *Five Books*. The latter book spread through the East, accumulating new tales from local folklore as it moved, and was called the *Hitopadesa*, or Book of Good Counsels. As it moved on into still other countries, references to Buddha were eliminated and the tales, when told in a Sanskrit version, introduced a wise old sage who supposedly told the stories to instruct the sons of a king. By the 6th century A.D. it had reached Persia, where it was first called *The Lights of Canopus*, referring to the star of wisdom, Canopus, and later by the title widely known today: *The Tales of Bidpai*. In this latter edition, the old *Jatakas* were told to an Indian king by a philosopher named Bidpai (q.v.). The Persians added to the original and accumulated tales new romances of magic, human shrewdness, and adventure, for the Persians were master storytellers and excelled in imaginative romances.

The Arabs got the collection from the Persians, calling it *Kalilah and Dimnah*, after the two jackals of the original *Jatakas*. The Jews got the stories from the Arabs and, after translating them into Hebrew and adding new inventions, carried them into western Europe. By the 13th century, the monks were copying them in a hundred monasteries, putting them first into Greek and Latin, and later into the vernacular.

In the 20th century, they are found in school readers, often headed erroneously *Aesop's Fables* or *LaFontaine's Fables*; in abridged translations such as Ellen Babbitt's *Jataka Tales* and *More Jataka Tales*; in adaptations, perhaps unwitting, of writers like Rudyard Kipling and Joel Chandler Harris, and in the stories that form the basis for *The Arabian Nights*.

Another Hindu collection important to the stream of children's literature is *The Seventy Tales of a Parrot* (SUKA SAPTATI, q.v.), later called *The Seven Wise Masters*. In this book each day, for seven days, romances and legends were told to a king. It is not in itself a children's book, but, together with the Arab version of the *Jataka* tales, *Kalilah and Dimnah*, it formed the basis for that great landmark in children's literature, *The Arabian Nights*. It has been because of this similar source of *The Arabian Nights* and the *Jatakas* that historians have sometimes given two separate tracings to these collections.

The Arabian Nights.—This collection, but its own contents, is recognizable as not all Arabian. It is obviously of Indian origin through the Persian, with a flavor of Chinese. Each land contributed something of its own nature until, when the medieval monks began its copying, it breathed the mystery of India, the magic of Egypt, the perfume of Persia's rose gardens and incense, and the romance of Arabia, to which were added the philosophy of China and the Hebrews. Also called *The Thousand and One Nights* because it contained, in its final accumulation, 1,001 stories hung on a single thread of narrative, it is one of the great books of all time. The titles of its stories call back the world of childhood: *Ali Baba and the Forty Thieves*, *Sindbad the Sailor*, *Aladdin or The Wonderful Lamp*, *The Merchant and the Genie*, *The Merchant of Bagdad*.

Ramayana and Mahabharata.—Besides the *Jatakas*, which grew and branched into an unparalleled literature, the Hindus also contributed two great epic poems dealing with the history and mythology of the Aryan or Hindu conquerors of India. These are the *Ramayana* and *Mahabharata* (qq.v.), both accumulations of legends and traditions in poetic form that later appeared in medieval translations and were incorporated, after the discovery of printing, into chapbook form for children.

Persia.—There is no one date which may be set as the end of the ancient period of composition and the beginning of the medieval period of compilation. But if there was any one nation that formed a link between the ancient composers and the medieval compilers, it was Persia. Early Persians and Hindus intermingled and their written literature was the same. But about the 4th century B.C. they separated and the Persians went westward to the highlands of what is now called Iran. The jungles of India inspired an animal-fable type of literature with the Hindus, but the highlands inspired tales of mysticism, magic, and romance with the Persians. Eventu-

ally a book evolved called the *Shah Nameh* (q.v.) or *Book of Kings*.

The Shah Nameh.—This was an incredibly lengthy compilation of an unknown scribe or scribes, containing 60,000 couplets in crude verse of folktales, legends, romance. From this book came such tales as *Sohrab and Rustum* (q.v.), made famous by Matthew Arnold.

Omar Khayyam.—From the Persians, too, comes such delicate poetry as that of Omar Khayyam. His *Rubáiyát*, written in the 11th century, is still singing in the pages of beloved little volumes. Persian literature, both prose and poetry, had a beauty and fragrance all its own, compounded of roses, spices, moonlight, enchantment, and the song of nightingales; it was truly "youth's sweet-scented manuscript." When the glory that was Persia's was over, it was the 14th century, and the medieval world had brought newer, but not better, songs and tales.

MEDIEVAL PERIOD

Monastic Compilers.—In conventional history, the Middle Ages are the thousand years from the middle of the 5th century A.D. to the middle of the 15th. But in literary history there is no such sharp division. Long after the genius of Greece and Egypt had died away, Persia was still composing new tales and embroidering the old ones, but Persia was an isolated oasis of literary creation. In Europe, the early centuries of the Christian era saw little new in literature, and wars and conquests temporarily effaced much of the old. Daily life in Europe, during the 5th, 6th, and 7th centuries was at a low level, intellectually. What little literature there was, both for children and adults, may be divided into the German (including Scandinavian and English), Celtic, French, Spanish, Italian. They were interdependent, borrowing from each other, with no one country producing much of merit that was new, except for the five flashes of literary brilliance that are discussed in the paragraphs immediately following.

The influence that may have kept all literature from being blotted out during the ten centuries of the Middle Ages, a period of incessant warfare, hard physical conditions and consequent ignorance, was the work of the scribes in monasteries of the Benedictine type. Benedict (St. Benedict of Nursia), born in Nursia (now Norcia), Italy, around 480 A.D., was profoundly impressed by the universal decay of education and the possible loss of the ancient learning and literature. He founded monasteries as a refuge for scholars and, before his death, around 544 A.D., he had set up schools in the monasteries for the education of young boys.

The rapidly spreading monastic organization, as started by Benedict, was a significant factor in the preservation and augmentation of children's literature, for the monks were set to the task of collecting and transcribing upon parchment and vellum the ancient manuscripts, and of writing texts for the pupils.

Closely associated with Benedict and with one of his prominent followers, Pope Gregory the Great, was Cassiodorus (490-585). An Italian, like Benedict, and a man of wealth, Cassiodorus founded a monastery upon his private estates, and traveled far to find literature for translating and transcribing. He was one of the profound scholars of his day as is shown in the extant fragments of his *History of the Goths* and his

Letters, both of which works contributed to the learning of the young.

The spread of monasteries of the Benedictine type in the 7th and 8th centuries made possible the restoring of much of the ancient works to readable form, the preserving of some sort of education with both elementary and advanced texts, and the beginnings of a new cycle of folk tale collecting. As a result of their missionary activities, the Benedictines penetrated England, Holland, Germany, Scandinavia, and Poland, until, by the end of the 11th century, Benedictine houses existed by the hundreds, giving seclusion and security to scholars who sometimes spent their entire lives in their austere, quiet cells, laboriously, often artistically, producing a written literature.

The majority of the manuscripts produced in the monasteries was strongly tinged with theology, but the copying was not entirely confined to saintly precepts and instructional texts. Tales from Egypt, fables from India, romances from Persia, and current folk tales and heroic cycles were also transcribed. A form of writing called dialogues, based on an ancient Greek innovation, was worked out for the instruction of the young, and riddles came into vogue. The use of the riddle and puzzle in teaching children is exemplified in a book by Aldhelm (c. 640-709) called: *The Number Seven, Meters, Enigmas, and Rules of Feet*, the enigmas referring to puzzles and riddles designed to teach metric problems.

Outstanding among the monastic scholars of the day were Bede, Alcuin, and Aelfric.

Bede (*Beda* or *Baeda*).—Bede, sometimes called the Venerable Bede, (c. 673-735), was important as an historian. He composed, among other works, a grammar, a book on natural phenomena, and an *Ecclesiastical History of England*, which, translated later from Latin into Anglo-Saxon by King Alfred, was long a required text for scholars.

Alcuin.—He was born in York (c. 735-804) and had perhaps the widest influence of his time, because he was the first to carry the growing learning of the British Isles to western Europe. He traveled to the court of Charlemagne, and there his influence displaced that of the Italians, who had occupied chief place in the new renaissance of letters. He wrote poems, histories, and elementary texts: grammar, rhetoric, mathematics. In his *Dialogue of Pepin* we see the intellectual exercises by which he taught the young.

Aelfric (955-1020).—Called the Grammarian, he was an English abbot and author educated at the Benedictine monastery at Winchester. He wrote 40 ecclesiastical homilies, a Latin grammar, and a glossary; more important were his *Lives of the Saints*, some of which were sufficiently lively to entertain as well as instruct the young. His *Colloquium*, a Latin dialogue designed to aid his pupils in Latin conversation, became widely used. Latin, at this date, was still regarded as the appropriate vehicle for works of any literary pretensions.

The Benedictines, although themselves producing no brilliant and lasting pieces of children's literature, recognized the need of books written especially for children. They were not world-minded with regard to history, as Herodotus had been, but they wrote histories that perpetuated the story of their times and, in addition, they gave to children encyclopedias of

what science they knew, chronology, astronomy, mathematics, and homilies on ethics. Some of the manuscripts copied by medieval monks had extraordinary beauty, the calligraphy lovely as a painting, the parchment or vellum decorated with scrolls, flowers, and human figures.

It was however, not out of the monasteries, but growing from the folk lore and romance cycles of the unlearned populace that the five great pieces of medieval literature came into existence which were to become a basic part of children's literature.

Song of Roland.—In France, the enduring masterpiece was *The Song of Roland*. This was one of hundreds of *chansons de geste* (q.v.) (songs of heroic deed), a type of epic in which the poetical and romantic French excelled. The material of the popular *chanson* dealt with the exploits of some national hero, mythical personage, or historical ruler. Roland was a knight who accompanied Charlemagne's army to Spain, and whose refusal to sound the horn which would summon the emperor to the rescue, during the army's retreat, forms the most dramatic episode of the narrative.

Beowulf.—An original piece of early Anglo-Saxon literature was *Beowulf* (q.v.), composed after the German invasion of Britain in the 5th century. The British Museum has a manuscript of *Beowulf* dated the year 1000, but it is considered much older than that. It must have been a recited tale of great age before it was committed to writing, for although the language is Anglo-Saxon, the hero and scenes are Scandinavian and German. The story tells of a young hero, Beowulf, brave and strong, who battles a monster (Grendel) in the hall of a king and slays him, but is later killed by a dragon. This old tale, clearly of the *Jack the Giant Killer* variety, is still being published for children in modern variants. It has many dramatic and colorful parts.

The Eddas.—The third work originated in the Scandinavian countries where there had been developing a cycle of heroic legends comparable to the Homeric tales. First collected in Iceland in the 13th century by a poet, Snorri Sturluson, they were called *Edda*. This first collection is now called the *Younger Edda*. A second book of Scandinavian hero tales, collected much later, in the 17th century, was called the *Elder Edda*. The honor of having been the homeland of the *Edda* has been claimed by Norway, Iceland, the British Isles, and Denmark, but Iceland points out with pardonable pride that it was the first to collect them. The *Edda* contained *The Story of Grettir the Strong*, and *The Story of the Volsungs and the Nibelungs*. These sagas (stories), passing over to Germany, became the basis of the Wagnerian tales of Siegfried and Brunhilde. See also EDDAS, THE.

King Arthur.—Growing in the Celtic and French lands all during this medieval period was a cycle of romance, epics, legends, and ballads clustered around a central figure: King Arthur. There are few children in Europe or America today who have not heard some wisps of the tales about King Arthur and his Knights of the Round Table, yet the origins of these engrossing and deathless narratives are lost. They were probably the joint product of France and England, or rather, of those peoples who occupied the opposite coastlines of the channel, during the early medieval times. It is not even

revealed historically whether there was a real Arthur whose heroic exploits started the cycle. It is only certain that after generations of verbal embellishments, and after many written versions had been circulated on both sides of the channel, there came the happy day in English literature when Sir Thomas Malory, in the second half of the 15th century, gave to the world *Morte d'Arthur* (q.v.). This great work brought to the world's children the adventures of the peerless King Arthur and his Knights of the Round Table: Launcelot, bravest of the 150 knights, Galahad, purest of them all, Launfal, Galahad's father who was King Arthur's steward, Queen Guinevere (Guanhumara)—unfaithful to Arthur, alas—and all the heroic men and lovely women whom poets and authors and dramatists have pictured ever since. The most popular later interpretation was in Tennyson's *Idylls of the King* (q.v.).

There are three separate narrative cycles associated with the Arthurian legends. First there is the story of Arthur's marriage to Guinevere, her love of Launcelot (Lancelot), and Arthur's death. The second is the quest of the Holy Grail, that sacred chalice in which the blood of Christ was preserved, and its finding by the one pure knight, Galahad. The third story is that of Tristan and Iseult, a completely separate tale, which was later set by Wagner into some of the world's most exalted music. See also ARTHURIAN ROMANCES; GRAIL, THE HOLY; TRISTAN UND ISOLDE.

Gesta Romanorum.—The fifth great work of medieval times was the *Gesta Romanorum* (DEEDS OF THE ROMANS). This collection, probably compiled about the end of the 13th century, was one of the most popular books of the time. Almost every monastery had its copy from which the monks transcribed new and more beautifully designed copies; storytellers and ballad singers built new romances upon its contents. It was a collection of anecdotes and tales, of fables and romances, that bear the ancient imprint of the Hindu Jatakas and the later *Panchatantra*. The *Gesta Romanorum* was a source book for Chaucer and Shakespeare, as well as for later authors. Because the book was written in the conventional Latin, it was given a Latin name, but the name was inappropriate, since the book comprises fragments of various origin, Oriental and European. The germ of the tale *Guy of Warwick* (q.v.) was contained here, and *Darius and His Three Sons*, stories that, in chapbook form, English children would learn by heart. Chaucer borrowed freely from it; Spenser used it for the basis of his *Faerie Queene* (q.v.); Shakespeare took over plots for *King Lear* and *The Merchant of Venice* (qq.v.). When printing was introduced, the stories from the *Gesta Romanorum* were among the first published.

Canterbury Tales.—Although Chaucer (1340-1400) is not in a direct line of children's literature, his *Canterbury Tales* (q.v.) had an influence which cannot be ignored. Chaucer's close observation of mankind, his interpretation of emotional reactions, his fidelity in recording speech and action, were forerunners of the 19th century realism in children's stories; from the *Canterbury Tales* have come some familiar themes in children's literature. See also CHAUCER, GEOFFREY; MILLER'S TALE OF THE CARPENTER, THE; NUN'S PRIEST'S TALE, THE.

CHILDREN'S LITERATURE



"The King and Queen of Hearts were seated on their throne . . . the Knave was standing before them, in chains near the King was the White Rabbit, with a trumpet in one hand, and a scroll of parchment in the other. In the very middle of the court was a table, with a large dish of tarts upon it. . . ."

These words of Lewis Carroll were illustrated by Sir John Tenniel's famous drawing of the court scene for the chapter, "Who Stole the Tarts?", in *Alice in Wonderland and Through the Looking Glass*.

Courtesy Grosset & Dunlap, Publishers

CHILDREN'S LITERATURE



Tom Sawyer and his cohorts speed up the last day of school by a trick on the schoolmaster. The illustration is by Donald McKay for *The Adventures of Tom Sawyer* by Mark Twain (New York 1946).

Courtesy Grosset & Dunlap, Publishers



Fritz Kredel's animals seem to talk, as the fox boasts to the cat of his many tricks in eluding dogs. Aesop's *Fables* (New York 1947).

Courtesy Grosset & Dunlap, Publishers



Illustration by Lucille Corcos of Prince Dolor, surrounded by his games, books and toys, in the tower, before word comes that his people want him for their king. Dinah Maria Mulock Craik, *The Little Lame Prince* (New York 1948).

Courtesy Grosset & Dunlap, Publishers



William Sharp's drawing of young David Balfour making the acquaintance of his Uncle Ebenezer, an early incident in Robert Louis Stevenson's *Kidnapped* (New York 1949).

Courtesy Random House, and of William Sharp

INFLUENCE OF THE PRINTING PRESS

It is natural that few books, except texts, were written in ancient and medieval days solely for children, for the production of a book was a laborious task. Moreover, paper was not plentiful, even by the 14th century; scribes still copied on parchment, or the precious and beautiful vellum (a leather especially processed).

The Chinese were the first to invent letterpress printing: the art of producing impressions by means of pressing an inked relief surface onto paper or other material. But China did not build a children's literature with their art. There is no certainty as to the date of the first European use of printing from movable type, nor which country used it first. It is only authenticated that by 1464 it had been introduced into Germany, and shortly thereafter into Switzerland, France, Holland, Belgium, and Spain. In all these countries, folk tales, because they were short, entertaining, and easy to print, were put into circulation, but one cannot picture children as reading them avidly, because few children could read.

Caxton.—William Caxton (c.1422–1491) was the first English printer. His name has outstanding significance in the history of children's literature, for he not only printed the old folk tales, many of which were crudely translated from the French or adapted from Italian translations of Greek and Latin classics, but, because England as an island had to build an early trade by sea in order to exist, he was able to send his little books abroad as soon as they were printed. Thus the English versions of old tales and poems became widely dispersed before the year 1500. Even well into the 20th century there were countries which had not dispersed their native writings, particularly writings for children.

In 14 to 15 years, Caxton produced around 100 known publications, and probably others which did not outlast his time. For children's reading, his most memorable books were *Reynard the Fox*, *Troilus and Cressida* (*Troilus and Cresida*), Malory's *King Arthur* (*Morte d'Arthur*), *The Golden Legend*, *Fables of Aesop*, *The History of Troy*, and *The Story of Jason*.

When Caxton died, his press passed to his assistant, Wynken de Worde (q.v.), who refined the art of printing, and whose publication of the *Gesta Romanorum* perpetuated these old tales for children. Wynken de Worde's edition, now kept at St. John's College, Cambridge, is the earliest one extant of this famous collection.

Hornbooks.—Paper was still not too plentiful, and children were, and are, destructive; therefore, around the year 1550 a new "book" was invented for their use: thin printed sheets pasted upon wooden paddles, covered by transparent horn and bound with brass. Known as hornbooks (q.v.), these gave elementary instruction only: the alphabet, syllables useful for the beginning reader, and the Lord's Prayer. Arithmetical exercises and religious instruction also appeared on some of the hornbooks.

Battledores.—Chiefly because it was durable, the hornbook lasted for 200 years in some form, yielding finally, around 1769, to the battledore, which consisted of sheets of cardboard folded over in book form. The battledore, too, was designed for elementary instruction only; it contained reading lessons for the beginner as well

as the alphabet, syllables, and numerals. In the New World, it was superseded by the *New England Primer* (q.v.), but in England, following the usefulness of the hornbook, it spread the knowledge of reading so that children of all classes were able to enjoy England's next publishing venture, the chapbook.

Chapbooks.—During the 17th and 18th centuries, England's presses, rapidly increasing in number, turned to an original type of mass literary production. Because more people, including children, were reading for entertainment, cheap books were devised, called chapbooks (q.v.) (from the early Anglo-Saxon word *ceap*, later pronounced *chap*, meaning cheap or common). The little books were peddled by chapmen (ceapmen). Merely pamphlets in their earlier forms, they consisted of a minimum of 4 and a maximum of 70 pages, folded but unstitched. They sold at from a penny to sixpence apiece, and commonly sold in lots, tied together. They were peddled over England and Scotland, carried by the same chapmen who peddled trinkets and articles of houseware and clothing to the farms, hamlets, and towns. For the first time in any country the populace had "books" in their homes—if these badly printed sheets may be termed books. Chapbooks contained the ancient tales of India, Greece, Rome, and Persia, the medieval romance cycles and narratives authored by Chaucer, little jingles and rhymes for the nursery age, fairy tales pirated from France and Italy. Later, chapbooks were exported to America, leavening the gloomy Puritan literature of the day. *Jack the Giant Killer* (q.v.) was a prime chapbook favorite with children, as was the perennial *Sir Bevis of Hampton*¹ (q.v.), the story of the doughty lad, sold to the heathens, who slew 60 for deriding Christianity, was given a wonderful horse, a mighty sword, captured a giant, and married a princess. Sir Bevis was the prototype of a hundred English literary heroes.

Robinson Crusoe.—During the 18th century, while chapbook popularity was at its height, England produced one immortal book of a different nature and length which was to be unique in the joy it would give to childhood. This was *Robinson Crusoe* (q.v.), published in 1719 by Daniel Defoe (c.1659–1731). Its theme of the solitary individual shipwrecked and surviving by his own resourcefulness was reminiscent of *The Shipwrecked Sailor*, written over 4,000 years previously in ancient Egypt, but its treatment was a new and fascinating realism. Defoe is justly called the first great realistic novelist; his imagination, which pictured the self-reliance and heroism of the human being cut off from human aid, invented such details that every adventure of Robinson Crusoe is still believable.

16TH, 17TH, AND 18TH CENTURIES

France.—*Fairy Tales.*—Always a poetical, artistic, and romantic country, France was the first to put traditional fairy tales in such charming and dramatic style that they became great literature as well as folklore. Like all new literary developments up to this time, the French fairy tale was first created to entertain adults. The courtiers of Louis XIV are credited with the innovation of this new art: the telling and writing of alluring tales of fantasy, designed to

¹ Also known as Sir Bevis of Southampton or sometimes Hamtown.

amuse the noble ladies and gentlemen of a court which demanded constant amusement. In 1697, Charles Perrault (1628-1703), already an elderly man, published a collection of eight stories which have remained a landmark in children's literature: *Contes de ma Mère l'Oye* (*Tales of Mother Goose*). These included *The Sleeping Beauty*, *Bluebeard*, *Little Red Riding Hood*, *Puss in Boots* (qq.v.), *Cinderella*, and *Tom Thumb*. Perrault, an architect, who published first in the name of his son, fearing ridicule, said that he had heard the stories from his son's nurse. They were not new tales; the origin of *Cinderella* alone goes back before historic records; Perrault's genius gave them universal appeal. Today, a monument to Perrault stands in the gardens of the Louvre in Paris—a life-size bust surrounded by a ring of dancing children, *Puss in Boots* in their midst.

Among the writers of original and adapted fairy tales who followed Perrault in France, three aristocratic ladies excelled: Marie Catherine Jumel, Countess D'Aulnoy; Madame Henriette Julie Murat; and Mademoiselle de la Force. The Countess D'Aulnoy is best remembered by *The White Cat*, *The Yellow Dwarf*, and *The Blue Bird*; Madame Murat's stories were sophisticated; Mlle. de la Force is remembered for *The Enchanter* and *Green and Blue*, tales of exaggerated marvels. See also FAIRY TALES.

Italy.—The rapid spread of printing as an art tangled the thread of children's literature as it passed from one country to another. Throughout all civilized lands, compilation and original productions appeared simultaneously and interwove because of growing trade and communications. Thus the contributions of 17th century France are listed before those of Italy in an historical tracing because the work of France was dispersed earlier, yet the stories of France may acknowledge to be based upon earlier Italian work. There were linguistic difficulties in Italian writings which confined them to small areas long after the work of French writers was given to the world.

The earliest known Italian collector of tales that would appeal to children was Giovanni Francesco Straparola, whose book, now known as *Straparola's Nights*, was published in 1550, and in complete form in 1554. Of his 74 stories, *Puss in Boots* and *Beauty and the Beast* were the immediate forerunners of the French variants.

Of equal importance in Italian letters was Giovanni Battista Basile (1575-1632), whose *Pentamerone* (*Five Books*) was written in about 1620, but in so archaic and difficult a Neapolitan dialect that the book was understandable to few. For over half a century it remained unknown not only to the world but to Italy itself. Basile, a gentle, imaginative poet, was born in Naples; he collected his stories as he traveled about the country as a soldier—a profession he detested and from which he took refuge in a mental world of charming fantasy. He divided the *Pentamerone* into five days, each containing ten stories, among which were *Cinderella*, *Rapunzel*, *Snow White*, *The Sleeping Beauty*, and *Hansel and Gretel*. Thus, Basile predated by many years the variants of these stories written by Perrault and the brothers Grimm.

Spain.—The Spanish, even more than the French, are a romantic people, fond of extra-

gant tales of adventure. Of their romantic novelists of this period Miguel de Cervantes (1547-1616) is acknowledged the master. His most celebrated work, *Don Quixote* (q.v.), gave to Spanish children and later to the children of the world a whole series of little tales all woven around the adventures of the absurd hero, Don Quixote, who, having read too many accounts of chivalry, goes forth into the world to right all wrongs. *Don Quixote* was translated into every language in Europe, and excerpts from it appear in innumerable children's anthologies. For some reason, it was never as popular with children of the United States as of other countries, which is unfortunate, for the book reveals the Spanish pride in manners and chivalry, as well as the inimitable Spanish humor.

Religious Writers.—No other period in children's literature is as clear-cut and definitive as the one now known as the Religious Period. Starting with the work of the monastic scribes who, naturally, injected theological doctrine into their own writings, religion as the basic theme of children's books reached its flowering in England around the year 1649. For perhaps a generation before this time church leaders had been alarmed at the rapid spread of chapbooks among the populace, and at the consequent freedom of thought and dissemination of knowledge which the art of printing was creating. Other social forces, besides the increasing literacy, were at work, too, and the result was that measures of repression were inaugurated by both church and state officials. A tremendous religious revival was started in England; the Bible replaced the chapbooks in the presses of the country, and *Guy of Warwick* yielded to the Old Testament Bible reading was carried on in churches and homes. Then a group of people, called the Puritans, a sect of English Protestants that arose in Elizabeth's reign, became a dominant force. I was from this group that the Pilgrim founder of New England came. Although the Puritans were strong upholders of freedom of conscience and simplicity of worship, they were scrupulously and narrowly strict in their religious life. Speedily they censored the reading of children. Their literature took on a rigid morality and a morbid concern with death. Chapbooks were still printed, to fill popular demand, but even the ungodly were filled with fear to give them to the children.

Typical of the English writers for children at this time, was the Reverend James Janeway. The book for which he is best known in the annals of children's literature was titled: *A Token for Children: being an Exact Account of the Conversion, Holy and Exemplary Lives, and Joyful Deaths of Several Young Children. To which is now added Prayers and Graces Fitted for the Use of Children*. This melancholy treatise told of good children who lead exemplary lives, to wit: brooded on eternal damnation and preached salvation to their elders, happily departing early to a better land.

The difference between these religious writers and the early monastic scribes, in the writing of children's books, was that the scribes interspersed doctrine with elementary educational material, whereas the later religious writer turned the doctrine into narrative channels and omitted the education. This does not mean that the Puritans ignored the education of the young; on the contrary, they fostered it in the form of

texts with a strong religious undertone but added to texts their innovation—the doctrinal narrative.

Pilgrim's Progress.—The theme of salvation and damnation expressed itself in only one great book: *Pilgrim's Progress* (q.v.) by John Bunyan (1628–1688). Bunyan was a man of the people, a tinker, and as such was not subjected to that influence which raised Elizabethan prose to the heights. He could only express the popular religion, because it affected his life deeply. His book became a second Bible, and children, permitted to hear it—indeed, forced to hear it—enjoyed the mystery and allegory without having to understand the theology. The theme of *Pilgrim's Progress* is a dream-allegory that represents the struggles and triumph of the Christian life. Its success with children was purely accidental, never dreamed of by its author, who, influenced by John Foxe's *Book of Martyrs*, had sought only to picture religious truths as he believed them.

The Puritans, arriving in New England, brought with them their rigid concepts of what children's literature should consist.

New England Primer.—The first important textbook published in the New World, possessing leaves and binding, thus differentiating it from the hornbook (which was almost immediately imported for children's use), was the *New England Primer*, first printed around 1649. This book was a combination of alphabet, spelling words, catechism, the Ten Commandments, and verses for religious training. For over one hundred years, in innumerable revised forms, this most famous of all early children's books was the standard beginning text in America. Its rhyming alphabet, which could be recited by almost every child, began:

A—In Adam's fall
We sinned all

And so on, with every letter followed by a religious verse.

Cotton Mather.—Cotton Mather (1663–1728) was best known of the children's writers in early American days. One of his books, first published in 1700, was reprinted for more than fifty years. Its gloomy title was *A Token for the Children of New England, and Some Examples of Children in Whom the Fear of God Was Remarkably Budding When They Died, in Several Parts of New England*. Cotton Mather had fifteen children of his own, but never wrote with tenderness or love, but solely to exhort and terrify.

Children's poetry of the day was of this nature:

I in the burial place may see
Graves shorter far than I;
From death's arrest no age is free,
Young children, too, may die.

Eighteenth Century.—*John Newbery*.—Fortunately for children, England, which had sent to the New World Puritanism and the pious sayings of children who died young, prepared an antidote. In the year 1744, an English publisher, John Newbery (1713–1767), printed a new kind of children's book. It was called *A Little Pretty Pocket-Book Intended for the Instruction and Amusement of Little Master Tommy and Pretty Miss Polly with Two Letters from Jack the Giant Killer*. By 1750, John Newbery was advertising in the *Philadelphia Gazette* a variety of children's books "all in a plain familiar Way

for Youth of Both Sexes." Newbery published close to 200 stories, most of which were devised with an understanding affection for children. Some of them dealt with "useful subjects," such as "eloquence and propriety, the solar system, Rules for Behavior, and the Seven Wonders of the World . . . All interpreted with Letters, Tales, and Fables, for Amusement and Instruction, and illustrated with cuts." But most of Newbery's books were just stories: *Robin Hood*, *Patient Griscl*, the immortal *Guy of Warwick*, and *Reynard the Fox*. For the nursery age, he published *Mother Goose's Melody or Sonnets for the Cradle*. In 1765, he printed *The History of Little Goody Two Shoes*, the authorship of which is attributed to Oliver Goldsmith. This latter book was perhaps the first full-length story written for children with an intent to realism.

Rousseau.—After Newbery's success in the publishing field, it is likely that writers for children would have carried still further the production of books for entertainment and amusement, but a new influence was introduced by French educational reformers. This movement was led by Jean Jacques Rousseau (1712–1778), a French social philosopher, educator, and writer. Rousseau loved nature and its beauties, and was intensely interested in the education of the young. He wrote on education with eloquence and warmth, and in his book *Emile, ou Traite de l'Education*, he outlined a new method of teaching useful knowledge to children. He pictured a child, *Emile*, accompanied always by a wise tutor, receiving his education through his own observations of nature and human activity, and by satisfying his needs for information and character development as situations made demands upon him.

This method of teaching children was carried over into the narrative field by later writers, by having child characters in stories learn by doing: learn of flowers and vegetables by planting and tending them; learn of animals by raising them; learn ciphering by playing at store-keeping and making change; learn self-reliance by being placed in situations that demanded it. The stories became more moralizing, stiff and pedantic, as the idea passed from the more indulgent France to England and America. In England, Thomas Day (1748–1789) was the best of the didactic writers. In his *History of Sandford and Merton*, a story, popular for many years, a clerical tutor trains two boys, one rich and the other poor, using the poor boy as the all-knowing, self-reliant one, and the rich boy as his foil. Maria Edgeworth (1767–1849) was a better writer than Day, but none the less didactic, although she told her moralizing tales with more skill and drama. Her *Parent's Assistant* and *Moral Tales* contained stories that are still included in popular collections.

MODERN PERIOD: 19TH CENTURY

During the 19th century, four separate channels were followed, differing with the national characteristics of peoples. These were: (1) stories of children's activities in contemporary or historical settings, pictured with some attempt at realistic portrayal; (2) picture books for small children produced by gifted artists; (3) national folk lore collected scientifically; (4) a new type of whimsy and fantasy. Because the

nations differed in the fields they pursued, one can only trace the developments in the separate countries which made the most original contributions.

Germany.—In Germany, fairy tale collecting became a science. The Teutonic passion for method and exactness led to a systematic collection and classification, best exemplified in the work of the two brothers Grimm. Jakob Ludwig Karl Grimm (1785–1863) and his brother Wilhelm (1786–1859) became interested in preserving folk lore records for scientific purposes, and to this end they gathered a mass of household tales from the peasantry throughout Germany. For 13 years they amassed a store of old tales before they began to select, to edit, and to publish. Their best-known collection is *Kinder-und-Hausmärchen*, known in English as *Grimm's Fairy Tales*. The Grimms were the first to discover the similarity of folk stories everywhere, and their collections started a national collecting and dispersal of folk literature that is being carried on to the present day.

Switzerland.—Johanna Spyri (1827–1901), living in Switzerland, but writing in German, was inspired at the identical period of Louisa May Alcott in the United States (see below) to write a realistic story of child life that was to remain a beloved classic—*Heidi*. This authentic, sincere story of a little girl in the Swiss mountains, her beloved grandfather and her herd of goats, gave an unforgettable picture of firelight on cabin walls, the sputter of toasting cheese, and the activities of happy childhood.

France.—The French genius for poetry and art expressed itself in delicate little verses for and about children, and in equally delicate illustrations for children's stories. The French artists developed a folio type of book, containing pictures with a single line of text. Narrative writers developed the Rousseau learning-through-experience theme, but one gifted novelist, Hector Malot, turned to realism of the *David Copperfield*, autobiographical variety. His *Nobody's Boy* and *Nobody's Girl* were translated into many languages. Jules Verne (1828–1905), although he did not write for children, struck a new vein of scientific adventure. Beginning with his first popular work *Cinq semaines en ballon*, published in 1863, he anticipated later discoveries in aerial and submarine navigation, and produced pseudo-scientific novels that, in translation, achieved world-wide popularity, notably his *Twenty Thousand Leagues Under the Sea*, *Around the World in Eighty Days*, and *From the Earth to the Moon*.

Denmark.—Denmark produced notable collections, but made its foremost contribution in the work of Hans Christian Andersen (1805–1875) who, at the age of 30, began to write some of the most original and the best adapted fairy tales that children's literature has ever known. He was soon famous over the entire civilized world as the gifted author of *The Ugly Duckling*, *The Dauntless Tin Soldier*, *The Tinder Box*, and *The Emperor's New Clothes*. See FAIRY TALES OF HANS CHRISTIAN ANDERSEN.

Italy.—Italy, following in the tradition of Giovanni Francesco Straparola and Giovanni Basile, pursued the imaginative field, and gave one of the world's most popular stories to children: *Pinocchio*, by "C. Collodi." Collodi, whose real name was Carlo Lorenzini, wrote his

famous story of the mischievous but lovable wooden marionette, after he was an elderly man and had retired from his life's work as editor and government official.

Ireland.—Ireland, long the homeland of the "little people" and the leprechauns, where, even today, many an Irish peasant would swear he could watch the fairies dancing in a moonlit glade if only he cared to chance their displeasure should they catch him peeping, began its collections of earliest Gaelic literature in 1825, when T. Crofton Croker published *Fairy Legends and Traditions of the South of Ireland*. The next important collector was Patrick Kennedy, a Dublin bookseller, who declared that he believed implicitly in fairies, as should every man and child who was willing to take the evidence of his own eyes, and, to prove his point, brought out, between the years 1866 and 1871, three books of currently popular tales. Among the Irish original creators was Frances Browne (1816–1879) whose book, *Granny's Wonderful Chair*, became a classic. To mention all the Irish writers who interested themselves in fairy tales of prime interest to children would be to mention almost all the Irish writers of the 19th century. Padraic Colum, born in 1881 and publishing well into the 20th century, is the most prolific of the talespinners who wrote expressly for children, using ancient as well as Irish themes for his tales. Best known of his books are *A Boy in Eirinn*, *The Children's Homer*, *The Golden Fleece*, *The Island of the Mighty*, and *Peep-Show Man*.

Norway.—Of all the Scandinavian countries, Norway has the most interesting folk stories for children. Trolls skip through the dark woods, and giants stalk the hillsides during the long nights. The two foremost 19th century collectors of Norwegian tales were Peter Asbjørnsen (1812–1885) and Jorgen Moe (1813–1882). Together they published two volumes—*Norwegian Folk Tales* and *Norwegian Fairy Tales and Folk Legends*. These books were translated into English by Sir George Dasent under the titles *Popular Tales from the Norse* and *Tales from the Fjeld*. Later, Gudrun Thorne-Thomsen, who was born in Norway but emigrated to America, made of these stories an outstanding children's book: *East o' the Sun and West o' the Moon*.

Russia.—A great country with a tremendous literature, Russia did not disperse all its children's stories to the outside world as England did. Its most important collector was Alexander Afanasief who, in 1863, published a volume called *Russian Popular Tales*, an enormous collection of 3,000 pages containing 332 stories. Afanasief, who had great literary talent, reveals how closely akin are the European and Slavic tales. His *The Dun Cow* is a variant of *Little One Eye*; *The Bear, the Dog, and the Cat* is like *The Bremen Town Musician*, and *The Miraculous Hen* is the familiar *Hen that Laid the Golden Egg*. In the stories of Afanasief one sees the deep sense of seriousness and social purpose of the Russians. Their children's stories do not appear to be written to amuse, as are the French, nor to instruct, as are the English, or to arouse, as are the American; but to be a social instrument for the creation of a large body of like-minded people. One sees peasants who wrest a bare living from the soil, warring on the wolf, the bear, the fox, and on witches and

devils. No stories from any lands tell of as many witches and devils as do the Russian children's stories. J. A. Khudyakof's collection, called *Great Russian Tales*, was published in 1864, and contained 122 stories. A. A. Erlendvein's, called *Popular Stories*, was published in 1863, containing 41. E. A. Chudinsky's, called *Russian Popular Tales*, contained 31. But the work of these three men is only a repetition and continuation of Afanasief's.

Sweden.—This land takes pride in the children's writer Selma Lagerlöf (1858–1940). Although she did not complete her greatest classic for children, *Nils Holgersson's Wonderful Journey through Sweden*, now known in English as *The Wonderful Adventures of Nils*, until 1907, much of her writing was done in the 19th century. *The Girl from the Marsh Croft* and *Further Adventures of Nils* brought her to permanent fame in children's literature. In 1909 she received the Nobel Prize for literature, and in 1914 she was elected to the Swedish Academy—the first woman so honored. Children's literature was thus given the highest approval as a separate art.

England.—In the 19th century, England diversified its children's literature to a wider extent than any other country. Its chief contributions were in the nonsense verse; a new kind of whimsy and fantasy; and picture books either by artists who collaborated with writers or by artists who possessed the twin talent of writing. Edward Lear's *Book of Nonsense* (1846), verses and pictures designed only to amuse, struck a keynote for the nation. Next in importance came the book that England herself calls her greatest contribution to children's literature—*Alice in Wonderland*, written by Lewis Carroll (pseudonym for Charles Lutwidge Dodgson, 1832–1898). Written to amuse a little girl, Alice, and her sisters, the nonsense of this book so delighted adults and children alike, that Dodgson wrote a sequel *Through the Looking Glass and What Alice Found There*. The two little books were sensationally popular on both sides of the Atlantic, and are still extensively quoted.

England's artists, turning to children's books as a new outlet for their talent, began to illustrate and to write. Great names come from England's 19th century artists—Kate Greenaway: *Apple Pie, Under the Window, Marigold Garden, Mother Goose*; Walter Crane—*Baby's Own Aesop*; Randolph Caldecott—*Come Lassies, Hey Diddle Picture Book*, and others; L. Leslie Brooke—*The Golden Goose Book, The Three Little Pigs, Johnny Crow's Garden, The Tailor and the Crow*; Beatrix Potter—*Peter Rabbit* series.

Although Beatrix Potter's *The Adventures of Peter Rabbit* was to become the most popular of all children's stories for the very young, Randolph Caldecott (1846–1886) possessed perhaps the greatest talent as an illustrator. He published 16 books for children, picturing horses, dogs, activities of children, and scenes of the English countryside. The Caldecott picture books are world classics. The late 19th century led another great artist to England's imposing list: Arthur Rackham (1867–1939). Although Rackham's best-known illustrating was done in the 20th century, he was beginning to be known in the 1890's. Rackham illustrated principally the work of others, preferring the traditional fairy tales for which he painted deli-

cately beautiful pictures in subdued blues, greens, and golden browns, but he published two books under his own name: *Arthur Rackham's Book of Pictures* (1913), and *The Arthur Rackham Fairy Book* (1933).

England's original fairy tales, collections of old tales, and animal stories were voluminous in quantity, and cannot be listed adequately here. Dinah Mulock Craik (1826–1887) wrote the beloved *Little Lamé Prince, The Adventures of a Brownie*, and *The Fairy Book*, although she preferred to be known as the author of *John Halifax, Gentleman*. George MacDonald (1824–1905) wrote *At the Back of the North Wind, The Princess and the Goblin*, and *The Princess and Curdie*. A scholarly antiquarian, James Orchard Halliwell, published in 1842 *Nursery Rhymes of England*, and, later, *Popular Rhymes and Nursery Tales*, two books that later reprinted in one volume called *Nursery Rhymes and Tales* are still basic in the field of jingles and nursery classics. Joseph Jacobs (1854–1916) collected six volumes of fairy tales that had originated in ancient and medieval days. Andrew Lang (1844–1912), the most popular of all English collectors of fairy tales, published close to 100 books, as well as magazine articles. Best known are his fairy tales named for colors—*The Blue Fairy Book, The Red Fairy Book*, and others. Two English writers who lived in both the 19th and 20th centuries belong in this period because of the nature of their work. Kenneth Grahame (1859–1932) wrote only one successful book, but it was outstanding as a talking-beast tale—*The Wind in the Willows*. And combining fantasy with realism came the incomparable Rudyard Kipling (1865–1936), whose tremendous literary output included the children's classics—*Kim, The Jungle Book, Second Jungle Book*, and *Just So Stories*.

The English master of adventure tales in this century was Robert Louis Stevenson (1850–1894), whose *Treasure Island*, and *Kidnapped* (qq.v.) took permanent place as classics. His versatility was further revealed in *A Child's Garden of Verses and Ballads*.

George Alfred Henty (1832–1902), British war correspondent, was a prolific writer of boys' stories that achieved wide popularity in both England and the United States.

England's 19th century writers took high rank in world literature; it was an age of scientific thought and practical reform. Prose and poetry alike were imbued with an ethical purpose, and novelists turned to social problems as their themes. Because of what Dickens called "the romantic aspect of familiar things," a considerable part of the literature designed for adults turned out to have those qualities of vivid expression and swift action that appeal to the young. Therefore, much of the work of England's great novelists became a part of children's literature. Children everywhere were fascinated by the graphic tales which, in the words of Dickens, sought to "banish from earth some few monsters of selfishness, malignity, and hypocrisy, set to rights a few obvious imperfections in the machinery of society, inspire all men with a cheery benevolence . . ." all of which accomplishment would have the effect of making everything "go well with this excellent world of ours." Chief among the 19th century English novelists and poets whose work, in part, was read by children were (listed in order of birth-date,

with 1803): Edward Bulwer-Lytton, Alfred (Lord) Tennyson, William M. Thackeray, Charles Dickens, Charles Reade, Charlotte Brontë, Charles Kingsley, George Eliot, John Ruskin, Jean Ingelow, Thomas Hughes, Wilkie Collins, George MacDonald, R. D. Blackmore, Dinah Maria Mulock, Thomas Hardy, W. H. Hudson, Joseph Conrad, A. Conan Doyle, Sir James Barrie, Rudyard Kipling, Arnold Bennett, John Galsworthy, Walter de la Mare, John Masfield, and Lytton Strachey. It is an imposing list that may be added to by any of the devoted readers of a generation ago. It is debatable whether any other country produced as much entertaining fiction which received world-wide attention through translations as did the English novelists of the 19th century.

United States.—Realism was America's greatest contribution to children's literature in the 19th century, but it entered upon this gradually. Variations of the instruction-through-activity method, as innovated in France by Rousseau, became widely used in stories for children. Samuel G. Goodrich (1793-1860) was the first to combine the method with literary merit. Under the pseudonym of Peter Parley, Goodrich wrote more than a hundred books for young people, picturing children learning geography, history, art, and science by traveling and seeing at first hand the material they were learning.

Jacob Abbott (1803-1879), a leader in education, was the first to use this method in long series form. He wrote the Rollo travel books in 28 volumes, in which Rollo travels through many countries learning by seeing and taking part in the lives of other peoples. His *Franconia* stories ran to 10 volumes. Platitudinous and moralistic though these books may sound to modern readers, they were an advance in children's literature. The domination of the religious and moralistic writers weakened with the publication in 1819 of Washington Irving's *Sketch Book* (q.v.), containing *Rip Van Winkle* and *The Legend of Sleepy Hollow* (q.v.). Irving's genial spirit brought warmth to stories that children craved; they had so long been chilled by moral tales and preaching. Nathaniel Hawthorne (1804-1864), following Irving, combined a poetic spirit with a charming style. His *Grandfather's Chair*, *Biographical Stories for Children*, *The Wonder Book*, and *Tanglewood Tales* (q.v.) were a fresh breeze blowing away a miasma of foggy mediocrity and patronage.

Of the many children's poets, the sisters Jane Taylor (1783-1824) and Ann (1782-1866), and Alice Carey (1820-1871) and her sister Phoebe (1824-1871) were the earliest to become popular. Phoebe Carey's *The Leak in the Dike* is still enjoyed, as is Jane Taylor's *Twinkle, Twinkle, Little Star*. But two greater poets were James Whitcomb Riley (1849-1916) and Eugene Field (1850-1895). Riley was pre-eminent as an interpreter of the simple life in childhood in kindly, homespun verse; of his 14 published volumes, the most popular were *Rhymes of Childhood*, and *A Child World*. Eugene Field was an author and poet of rare sympathy. His *With Trumpet and Drum*, *Poems of Childhood*, and other volumes showed unusual powers of appreciation and understanding.

The two writers who helped turn the stream of children's literature toward realism in the 19th century were not primarily children's writers, although their books were immediately taken

over by older children. These were James Fenimore Cooper and Herman Melville. Cooper (1789-1851) was the first American writer to extend the domain of fiction over the American scene—its great forests and prairies, and surrounding seas. Children found most interest in his *Leatherstocking* series, stories of adventure and of Indian life, including *The Deerslayer*, *The Last of the Mohicans* (qq.v.), *The Pathfinder*, *The Pioneers*, and *The Prairie*. Herman Melville (1818-1891) wrote sea stories: *Moby Dick*, *Typee*, *Omoo* (qq.v.), *Redburn*, *White Jacket*, and *Mardi*, all high adventure tales, well told, in authentic settings.

The first American juvenile writer to devise a new pattern of realism was Louisa May Alcott (1832-1888). Her *Little Women* (q.v.) broke completely from the English and Continental tradition of writing for children and was as American as the ice-cream soda. This simple, believable narrative of the home life of four girls and their parents created, not types of children as such stories as *Little Goody Two-Shoes* had done, but characters who sprang from the pages as real people to bring utter conviction and delight to child readers. Her format was so new that a publisher could not immediately be found who could believe in the success of such a factual, detailed narrative of home activities. *Little Women* was phenomenally successful, and was soon followed by Miss Alcott's *An Old-Fashioned Girl*, *Eight Cousins*, *Silver Pitchers*, *Under the Lilacs*, *Little Men*, *Rose in Bloom*, *Jo's Boys*, and other stories, all of which rank among the most highly esteemed American fiction for young people.

Before Miss Alcott finished her brilliant career, other writers were branching into new fields of realism. Mary Mapes Dodge (1831-1905) editor, poet, and juvenile writer, published *Hans Brinker, or The Silver Skates*, a story that became a beloved classic on both sides of the Atlantic. *The Land of Pluck* and *The Golden Gate* followed, and from 1873, Mrs. Dodge ably edited the juvenile periodical *St. Nicholas*, which, for years, was to carry outstanding verse and prose for children.

Kate Douglas Wiggin (1856-1923) followed in the tradition of Mary Mapes Dodge, producing the widely popular stories—*The Bird's Christmas Carol*, *Mother Carey's Chickens*, and *Rebecca of Sunnybrook Farm*.

Other American women writers of the 19th century and their best-known works were: Jane Andrews, *Each and All*; Eleanor Atkinson, *Greyfriars Bobby*; Jane Goodwin Austin, *Standish of Standish*; Frances Hodgson Burnett, *Little Lord Fauntleroy* (q.v.); Martha Finley (Martha Farquharson), *Elsie Dinmore* series; Lucretia Peabody Hale, *The Peterkin Papers*; Jean Ingelow, *Mopsa the Fairy*; Sarah Orne Jewett, *Betty Leicester*; Margaret Sidney (Lothrop), *Five Little Peppers* series, and Frances Baylor (Barnum), *Juan and Juanita*.

Two writers who used the love story successfully for teen-age girls were: Susan Coolidge (Sarah Chauncey Woolsey), *What Katy Did* series; and Helen Hunt Jackson, *Ramona* (q.v.), two forerunners of a host of writers in a new field of children's stories based on the oldest of all themes.

Men writers of the 19th century turned to adventure, picturing boys in contemporary or historical settings. Best known of these writers

and their books which became most popular were: Thomas Bailey Aldrich: *The Story of a Bad Boy*; James Baldwin, *The Story of Roland*; John Bennett, *Master Skylark*; Eldridge Brooks, *The Master of the Strong Hearts*; Noah Brooks, *The Boy Emigrants*; Edward Eggleston, *The Loosier Schoolboy*; Oliver Optic (William Taylor Adams), *Onward and Upward* series; James Otis (James Otis Kaler), *Toby Tyler*; Thomas Nelson Page, *Two Little Confederates*; Howard Pyle, first of the distinguished artist-authors, *The Merry Adventures of Robin Hood* and other stories; Horace E. Scudder, *George Washington*; and John Trowbridge, *Cudjo's Cave*. Frank R. Stockton, famous as a humorist, created not only realistic stories, but fanciful stories as well.

The series books, which became very popular toward mid-century, were best exemplified in the work of Joseph A. Altsheler (1862-1919) who wrote of various periods in American history: a *Civil War* series, a *French and Indian War* series, the *Young Trailers* series.

Joel Chandler Harris (1848-1908), best of the collectors of southern folk tales, became eminent for his Afro-American studies. His *Uncle Remus* (q.v.) tales, markedly similar to the Hindu *Jatakas*, tied the New World literature to the old as did no other author's.

To round out the 19th century and raise realism to a new height, there appeared, in 1876, Mark Twain's *Adventures of Tom Sawyer*. Mark Twain (Samuel Langhorne Clemens: 1835-1919) American humorist, was more completely realistic than any preceding writer for children; his characters emerged with all the good and bad intermingled that their times made inevitable. Among his many books, all of which became classics, *The Adventures of Huckleberry Finn* (1885) was also high in the esteem of children.

During the second half of the 19th century, a split appeared between books that held widespread popular appeal for children and books that received adult approval. The books listed above happily combined both, but this was not true of many. The work of L. Frank Baum (1856-1919) revealed this split at its widest. Baum wrote *The Wonderful Wizard of Oz* (1900), followed by a long series of Oz books. They sold by the hundred thousands, and for over fifty years led many lists of best-liked books for children 8 to 12 years of age, but adults termed them "fantastical trash."

The Oz books endured in spite of adult disapproval, but the dime novels, first appearing in the summer of 1860, did not endure. These cheap little paper-covered books or pamphlets, dramatized the American pioneers and the opening of the West. The first novel of young Edward S. Ellis, *Señor Jones; or The Captive of the Frontier*, sold, in dime novel format, 600,000 copies, and was translated into a number of foreign languages. Other dime novels dealt with pirates and whalers, hunters, soldiers, and Indians, and with adventure on the prairie. In three years' time, five million dime novels had been sold, and after ten years there was hardly an American boy who did not have a stack of them secreted from parental eyes. When they died of their own unbridled sensationalism, their place was taken by paper-covered series books of youthful achievement. Horatio Alger (1834-1899) wrote 130 books with the rags-to-riches formula—From

Farm Boy to Senator, Joe's Luck, Brave and Bold. Burt L. Standish (Gilbert Patten) wrote 900 stories, all dealing with the school and athletic adventures of a flawless hero, Frank Merriwell, and his brother Dick. Later reprinted three to a volume, these made 208 books, of which 125,000,000 copies were sold. Alger and Patten were the last of a group of prolific writers whose output was unparalleled in quantity, yet so hastily written that not a single story endured. The immediate successor of the paper-covered tale of sports and adventure was a throw-back to the dime novel and the older chap-books. Called the "Comics" because originally they were designed to amuse, and when they first appeared were called "Comic-strips" in newspapers, the 20th-century Comic was (usually) an unbound stitched or pasted pamphlet of pictures with a few lines of explanatory text, often lurid and sensational, dealing with much the same type of fantastic adventure—though in more modern guise—as had brought adult displeasure down upon the publication of the dime novels. More interesting to boys than to girls, they were notably popular with the enlisted men of World Wars I and II. Either because adults have grown more tolerant or more understanding, they have received far less opprobrium than the earlier dime novels; they are sold in vast numbers in drug-stores across the entire United States. In their continued newspaper form, they sometimes achieve a new form of native art that is as much enjoyed by adults as by children.

MODERN PERIOD: 20TH CENTURY

In the first half of the 20th century, two world wars affected the printing trade in Europe. France and Germany produced picture books for small children that were unexcelled in artistry but lagged in books for older children. England, the Lowlands, and the Scandinavian countries were handicapped, sometimes from the simple lack of paper; yet England produced some of the best children's poetry of the first half of the century, along with a few adventure stories that were excellent examples of their type.

United States.—In the United States, the unprecedented industrial expansion made possible the widest diversification in juvenile literature. It was a transition period in the United States, with writers striving to reconcile adult requirements with child interest, and to capture in literary form suitable for children all the new scientific and industrial developments. And beyond these general factors, there were several forces at work that profoundly influenced children's books.

First and most important, there was the growth of the public library and the training of children's librarians. These trained women encouraged the circulation of choice books and discouraged that of the ephemeral and sensational; they created children's rooms that were quiet oases of literary delights.

Second, public schools opened school libraries, as tools of education and included a widely diversified literature, which grew as teachers and librarians learned to coordinate their efforts.

Third, publishers established special children's departments, where editors vied in enticing the best talent into the field.

Fourth, the American Booksellers' Association inaugurated Book Week, designed to display the best books for children. Since 1919, Book Week has been featured annually in the United States,

CALDECOTT PRIZE WINNERS

Year	Artist	Title of book
1938	Dorothy Lathrop	<i>Animals of the Bible</i>
1939	Thomas Handforth	<i>Mai Li</i>
1940	Ingri and Edgar Parin d'Aulaire	<i>Abraham Lincoln</i>
1941	Robert Lawson	<i>They Were Strong and Good</i>
1942	Robert McCloskey	<i>Make Way for Ducklings</i>
1943	Virginia Lee Burton	<i>The Little House</i>
1944	Louis Slobodkin	<i>Many Moons</i> (text by James Thurber)
1945	Elizabeth Orton Jones	<i>Prayer for a Child</i> (text by Rachel Field)
1946	Maud and Miska Petersham	<i>The Rooster Crows</i>
1947	Leonard Weisgard	<i>The Little Island</i> (text by Margaret Wise Brown)
1948	Roger Duvoisin	<i>White Snow, Bright Snow</i> (text by Alvin Treaselt)
1949	Berta and Elmer Hader	<i>Big Snow</i>
1950	Leo Politi	<i>Song of the Swallows</i>
1951	Katherine Milhous	<i>The Egg Tree</i>
1952	Nicolas Mordvinoff (with William Lipkind)	<i>Finders Keepers</i>
1953	Lynd Ward	<i>The Biggest Bear</i>
1954	Ludwig Bemelmans	<i>Madeline's Rescue</i>
1955	Marcia Brown	<i>Cinderella</i>

NEWBERY PRIZE WINNERS

Year	Author	Book
1922	Hendrik Willem van Loon	<i>The Story of Mankind</i>
1923	Hugh Lofting	<i>The Voyages of Dr. Dolittle</i>
1924	Charles Boardman Hawes	<i>The Dark Frigate</i>
1925	Charles Joseph Finger	<i>Tales from Silver Lands</i>
1926	Arthur Bowie Chrisman	<i>Shen of the Sea</i>
1927	Will James	<i>Smoky, the Cowhorse</i>
1928	Dhan Gopal Mukerji	<i>Gay-Nech</i>
1929	Eric P. Kelly	<i>The Trumpeter of Krakow</i>
1930	Rachel Lyman Field	<i>Hitty, Her First Hundred Years</i>
1931	Elizabeth Coatsworth	<i>The Cat Who Went to Heaven</i>
1932	Laura Adams Armer	<i>Waterless Mountain</i>
1933	Elizabeth Foreman Lewis	<i>Young Fu of the Upper Yangtze</i>
1934	Cornelia Lynde Meigs	<i>Invisible Louisa</i>
1935	Monica Shannon	<i>Dobry</i>
1936	Carol Ryrie Brink	<i>Caddy Woodlawn</i>
1937	Ruth Sawyer	<i>Roller Skates</i>
1938	Kate Seredy	<i>The White Stag</i>
1939	Elizabeth Enright	<i>Thimble Summer</i>
1940	James Daugherty	<i>Daniel Boone</i>
1941	Armstrong Sperry	<i>Call It Courage</i>
1942	Walter D. Edmonds	<i>The Matchlock Gun</i>
1943	Elizabeth Janet Gray	<i>Adam of the Road</i>
1944	Esther Forbes	<i>Johnny Tremain</i>
1945	Robert Lawson	<i>Rabbit Hill</i>
1946	Lois Lenski	<i>Strawberry Girl</i>
1947	Carolyn Bailey	<i>Miss Hickory</i>
1948	William Pène duBois	<i>Twenty-One Balloons</i>
1949	Marguerite Henry	<i>King of the Wind</i>
1950	Marguerite de Angeli	<i>Door in the Wall</i>
1951	Elizabeth Yates	<i>Amos Fortune, Free Man</i>
1952	Eleanor Estes	<i>Ginger Pye</i>
1953	Ann Nolan Clark	<i>The Secret of the Andes</i>
1954	Joseph Krumpolt	<i>And Now Miguel</i>
1955	Meindert De Jong	<i>The Wheel on the School</i>

and was followed throughout other countries until, by 1950, twelve separate nations were holding national book weeks.

Finally came the stimulation given by awards for the best children's books. In the United States, this movement began in 1921 when the children's section of the American Librarians' Association voted to award a medal annually to "the most distinguished children's book written by an American author in the preceding year." This medal was called The Newbery Medal in honor of the 18th century English bookseller, John Newbery.

Frederic G. Melcher, who endowed the Newbery Medal, also established and endowed a second medal for the most distinguished American picture book for children published each year. It is called the Caldecott Medal, in honor of the English artist, Randolph Caldecott. Its winners have been artist-authors, or illustrators of others' work.

Canada.—The Canadian Association of Children's Librarians awards a medal for the outstanding children's book by a Canadian author. This medal honors Madame Louis Hébert, wife of the first Canadian farmer, who instructed French and Indian children in her own home.

HEBERT MEDAL WINNERS

Year	Author	Book
1946	Roderick Haig-Brown	<i>Starbuck Valley Wint</i>
1947	No award	
1948	B. Mabel Dunham	<i>Kristli's Trees</i>
1949	R. S. Lambert	<i>Franklin of the Arctic</i>
1950	No award	
1951	Catherine Anthony Clark	<i>The Sun Horse</i>
1952	No award	
1953	No award to an English book; French award: Reverend Emile Gervais	<i>Le Venerable François de Montmorency-Laval</i>

Annual winners of the Governor-General Medal have been:

CANADIAN LITERATURE

Year	Author	Book
1950	R. S. Lambert	<i>Franklin of the Arctic</i>
1951	D. Donald Dickie	<i>The Great Adventure</i>
1952	John F. Hayes	<i>A Land Divided</i>
1953	Marie McPhedran	<i>Cargoes on the Great</i>
1954	John F. Hayes	<i>as We Ride at Night</i>

Twentieth Century Types.—*Nursery Tales and Picture Books*: First place for nursery tales written in the 20th century went to an English woman, Helen Bannerman, for the inimitable *Little Black Sambo*. It took a place with Beatrix Potter's *Peter Rabbit* in the affections of small children, sharing eminence only with the immortal *Three Little Pigs* and Robert Southey's *Goldilocks and the Three Bears*. In picture books, France led all other nations in the picturing of animals in whimsical and comical situations. The *Babar, the Elephant* books, by Jean de Brunhoff, of France, were rated the most novel of the half-century's picture books. Germany was the acknowledged leader in artistry and colors until the wars ended their production. The pictures printed in Germany for Sibylle v. Olfers' *When the Root Children Wake Up* received international acclaim for rare coloring and beauty.

Folk, Fairy, and Nonsense Tales and Talking-Animal Stories.—The national collecting of folklore, accelerated by the work of the brothers Grimm in Germany, spread during the 20th century to every country on the globe. Where national genius did not exist for literary productions, as in Africa, outside writers went in to collect the native folklore. Translations appeared with illustrations to make the stories more appealing to children. To the traditional material, new talking-animal tales and droll tales of nonsense were added. Typical of the best in America for younger children were Margery Bianco's *The Little Wooden Doll*, *Poor Cecco*, and *The Velveteen Rabbit*, and in England were A. A. Milne's *Winnie-the-Pooh* stories. For children a little older, rated high were Hugh Lofting's *Dr. Dolittle* books, Pamela Travers' *Mary Poppins*, and Richard and Florence Atwater's *Mr. Popper's Penguins*.

Legends.—These stories, which in previous centuries, had told of the exaggerated achievements of popular heroes or gods, changed in the 20th century to the tall tale. In the United States, the tall tale swelled into mighty proportions with five regional heroes: Paul Bunyan, the logger; Pecos Bill, from the Western plains; Tony Beaver, from the South; John Henry, the steel-driving man, and Old Stormalong, from the New England coast. More than ten writers made good collections of these tales.

History.—Histories which subordinated dates and wars to accounts of the social and industrial life of the people appeared in the 20th century for juvenile readers. Among the best published in the United States were Virgil Hillyer's *A Child's History of the World*, Hendrik Van Loon's *Story of Mankind*, Ramon Coffman's *Our America*, and Eva March Tappan's *American History Stories*, and *The Story of Our Constitution*. Of far more interest to children, however, were the books of historical fiction. Howard Pyle (1853-1911), the eminent illustrator-author, was the first American writer to perfect this type of writing, notably in *Otto of the Silver Hand* and *Men of Iron*, stories of the medieval period in Europe. Elizabeth Janet Gray followed in his realistic tradition with *Adam of the Road*; Evalene Stein with *Gabriel and the Hour Book*, *A Little Shepherd of Provence*, and *Troubadour Tales*; Katharine Gibson with *Oak Tree House and Jock's Castle*, and Stephen Meader with *Who Rides in the Dark*. Books of American historical fiction became especially numer-

ous; the period of pioneer life gave writers colorful, dramatic material. Some of the best were Cornelia Meigs' *Clearing Weather* and *Master Simon's Garden*; Walter D. Edmonds' *The Matchlock Gun*; Rachel Field's *Calico Bush*; Esther Forbes' *Johnny Tremain*; Carol Ryrie Brink's *Caddy Woodlawn* (a prime favorite); and Laura Ingalls Wilder's *Little House in the Big Woods*.

Biography.—After 1930, biographies increased rapidly in number; within ten years time over 150 good biographies appeared for children, most of them well illustrated and written in lively narrative style. Every type of person was covered by the biographers—statesmen, eminent women, scientists, pioneers, explorers, musicians, artists, writers. A few of the titles, published in the United States, will indicate the scope of these books: *The Romantic Rebel* by Hildegard Hawthorne (the life of Nathaniel Hawthorne), *Nansen* by Anna Hall, *Pasteur* by Francis Benz, *Abe Lincoln Grows Up* by Carl Sandburg, *Daniel Boone* by Stuart White, illustrated by James Daugherty, *Amundsen, the Splendid Norseman* by Bellamy Partridge, *Penn* by Elizabeth Gray, *Young Lafayette* by Jeanette Eaton, *George Washington Carver* by Rackham Holt, *Haym Solomon, Son of Liberty* by Howard Fast, *Drina, England's Young Victoria* by Marion Flexner, *Madame Curie* by Eve Curie, *He Heard America Sing* (the life of Stephen Foster) by Claire Purdy; and *Deep Flowing Brook* (the life of Bach) by Madeleine Goss.

International Themes in Fiction: Stories of children of other lands had been popular in English-speaking countries ever since Mary Mapes Dodge's *Hans Brinker* and Johanna Spyri's *Heidi*. In the 20th century, a growing consciousness of "One World" led to a wider interest in the contemporary life of children in other countries. A few books that illustrate this highly popular trend were: *Poppy Seed Cakes* by Margery Clark (Mary Clark and Margery Quigley), stories with a Russian atmosphere; *Pelle's New Suit* by Elsa Beskow, and *Snipp, Snapp, Snurr and the Red Shoes* by Maj Jan Lindman, both translations from the Swedish; *Young Fu of the Upper Yangtze*, *Ho-Ming: Girl of New China*, *China Quest*, and *When the Typhoon Blows* by Elizabeth Foreman Lewis, pictures of modern China before the Japanese and Communist conquests; *Little Pear and Little Pear and His Friends* by Eleanor Frances Lattimore, artist-author, whose Chinese children are realistically portrayed; *Call It Courage* by Armstrong Sperry, the story of a Polynesian boy; *The Good Master and The Singing Tree*, by Kate Seredy, the adventures of a Hungarian tomboy; and *Dobry* by Monica Shannon, the story of a Bulgarian peasant boy.

Regional Stories.—The different regions of the United States and Canada gave material to writers of the 20th century for stories that dramatized the differences in customs and traditions of separated regions. The *Augustus* books of Le Grand Henderson pictured the poor whites of the South; *Henner's Lydia, Thee, Hannah*, and other books of Marguerite de Angeli were tales of the Amish, Quakers, and Pennsylvania Dutch; *Araminta, Jerome Anthony*, and *Araminta's Goat* by Eva Knox Evans show Negro youngsters; *Waterless Mountain* and *Dark Circle of Branches* by Laura Armer were stories about Navajo Indians; *Chi-Wee* and

Chi-Wee and Loki by Grace and Carl Moon were stories of Pueblo children in their world of desert, mesa, and canyon. Among the regional stories were tales about minority groups, sometimes discriminated against in the social order, which brought social problems into children's literature. These stories told of child life in the Tennessee mountains and the Ozarks, family life among the migratory workers in California, stories of immigrants, and many accounts of Negro-white relationships.

Contemporary Adventure and Achievement: Although the majority of the regional books dealt with child adventure in contemporary settings, there were many adventure and family life stories that were not primarily regional in character. Rated high by librarians were the books of two English authors: Arthur Ransome, who wrote *Swallows and Amazons* and other stories, and Noel Streatfield, who wrote a *Shoes* series (*Ballet Shoes, Tennis Shoes*, etc.). Hilda Van Stockum, who lived in Holland, Ireland, and the United States, wrote four highly rated books about family life in the three countries: *The Cottage at Bantry Bay, Francie on the Run, Pegeen*, and *The Mitchells*. Of the American writers, Eleanor Estes achieved rare humor in the *Moffatt* stories. Elizabeth Enright, who won the Newbery Medal for *Thimble Summer*, a story of family life, wrote *The Saturdays, The Four Story Mistake*, and *Then There Were Five*, all family life adventures.

Stories of the achievements of girls in the professions and businesses were a 20th century innovation indicative of the changing social order. *Sue Barton, Student Nurse* and *Sue Barton, Senior Nurse* by H. D. Boylston were significantly popular with adolescent girls, as was *Peggy Covers the News* by Emma Bugbee. Alice Dalgliesh's *Silver Pencil* was also in this field—one in which writers lagged behind the reading demands of the times.

Animal Fiction.—Writers of animal stories in the 20th century turned from talking-beasts to the realistic portrayal of animal life in authentic settings. For small children, there were picture book animal stories, such as the *Angus* books and *Ping* by Marjorie Flack; *Mittens*, and other stories, by Clare Turlay; *Chuckle and Sniffy, the Story of a Skunk* by David M. Stearns; *Buttons* by Tom Robinson; *The Smallest Puppy* by Margaret Johnson and Helen Lossing; *The Skittle Skattle Monkey* by Dorothy Lathrop; and *Make Way for Ducklings* by Robert McCloskey. For children a little older and for the teen age, among the best-liked were: the *Blaze* stories by C. W. Anderson, who also wrote *Salute, High Courage*, and two biographies of great race horses; *Smoky, the Cow-Horse* by Will James; *Justin Morgan Had a Horse* by Marguerite Henry; *My Friend Flicka, Thunderhead*, and *Green Grass of Wyoming* by Mary O'Hara (Mary Sture-Vasa); *Lassie Come Home* by Eric Knight; the 9 animal stories of Clarence Hawkes, including *Redcoat, the Phantom Fox* and *King of the Flying Sledge*; *Watchers of the Trails* and other works, by Charles G. D. Roberts; *On Safari* and *The White Panther* by Theodore Waldeck; *The Yearling* by Marjorie Kinnan Rawlings; *Kari* by Dhan Gopal Mukerji; and, most popular of all with boy readers: *Silver Chief, Dog of the North* and *Silver Chief to the Rescue* by Jack O'Brien. Many animal-story writers owed a debt to Jack

London (1876–1916) whose *Call of the Wild* (q.v.) formed a much-used pattern of realistic animal adventure.

Natural Science.—The 20th century produced factual books on mammals, amphibians, reptiles, birds, insects, and the stars written in such style that older children, whose interests lay in those fields, could read and enjoy them. Recommended by librarians were William T. Hornaday's books on zoology, particularly *The American Natural History*; Raymond L. Ditmars' studies of reptiles and prehistoric animals; A. B. and J. H. Comstock's works on butterflies and insects; Jean Henri Fabre's narrative accounts of the insect world; Olive Thorne Miller's *Children's Book of Birds*; and G. E. Mitton's *The Book of Stars for Young People*.

Physical Science.—The first half of the 20th century saw scientific discoveries in physics, mechanics, and engineering in such quantity that literature lagged behind discovery. The splitting of the atom split the physical sciences as they were known and taught, and no listing of authors or subjects in this field can have significance until the ferment of discovery settles, and the physical sciences may become reasonable subjects for juvenile writers.

Poetry.—In the 20th century, England produced the two most widely read children's poets. Walter De la Mare was foremost. His *Songs of Childhood*, published in 1902, and his later volumes, *Peacock Pie* and *A Child's Day*, were lilting verses, whimsical and delicate, that were rare in beauty and rhythm. A. A. Milne wrote *When We Were Very Young* and *Now We Are Six*, two small books of comic, imaginative, and musical verses which went through more editions in less time than did any other books of children's poetry ever printed.

Encyclopedias.—Children's encyclopedias, which contain information on all phases of the arts and sciences, were improved to a high degree of completeness and authenticity in the 20th century. The most widely used were *The Book of Knowledge*, *The World Book*, and *Compton's Pictured Encyclopedia*.

A GROWING LIBRARY FOR THE CHILD

(Suggestions to parents)

No adult can predict accurately the exact age at which every child will enjoy a given book. Reading interests of children vary with sex, reading background, environment, individual differences in aptitudes, and intelligence. A parent may only add selected books to the child's bookshelves and let the child enjoy them when he will. As the library is a permanent possession it does not greatly matter when the different books are first appreciated. That is one of the advantages of a child's owning his own books; he has them when he is ready for them, and they become a part of childhood whether first read at 7 or at 12. *Peter Rabbit*, *The Three Bears*, *Little Black Sambo*, and their kindred immortals may be read to the child of 3, retold to him by his first-grade teacher, read by himself at 7, and re-read thereafter throughout life.

THE FIRST BOOKS

Mother Goose Nursery Rhymes and Jingles. There are The perfect First Book for every child. There are many good editions. The parent should choose one with a high quality of paper and binding and with appealing illustrations in color. *Little Mother Goose*, illustrated by Jessie Wilcox Smith; *Gay Mother Goose*, illustrated by Gustav Tenggren; *Mother Goose*; *Seventy*

seven Verses with Pictures by Taasha Tudor; *Ring o' Roses*, illustrated by L. Leslie Brooke are all outstanding collections, beautifully illustrated.

Animal Picture Book, in color.

There are many on the market, variously titled "Our Farm Friends," "Our Pets," and the like. The important thing is that the book (preferably printed on soft linen paper that the littlest children can handle) should contain pictures of the first animals that the child recognizes: the dog, the cat, the horse, the cow. There need be no text, except the name of the animal.

FOR AGES 2 THROUGH 6

These are "read-aloud" stories and picture books, which the adult introduces to the child first through reading them to him, and that the child later learns to read for himself. They will then be re-read up through eight years of age and older.

Animals Everywhere, by Ingri and Edgar Parin d'Aulaire
Ola, by Ingri and Edgar Parin d'Aulaire
Little Black Sambo, by Helen Bannerman
Hans, by Ludwig Bemelmans
Pelle's New Suit, by Elsa Beskow
The Velvetten Rabbit, by Margery Bianco
Five Chinese Brothers, by Claire Bishop
Golden Goose Book, by L. Leslie Brooke
Johnny Crow's Garden, by L. Leslie Brooke
Three Little Pigs, by L. Leslie Brooke (illustrator)
Stone Soup; an Old Tale, by Marcia Brown
Little House, by Virginia Lee Burton
Hey Diddle Diddle Picture Book, by Randolph Caldecott
Puppy Seed Cakes, by Mary Clark and Margery Quigley
Down, Down the Mountain, by Ellis Credle
A B C Book, by Charles Falls
Angus and the Ducks, by Marjorie Flack
Story about Ping, by Marjorie Flack
Millions of Cats, by Wanda Gág
500 Hats of Bartholomew Cubbins, by Geisel, Theodor S. (Dr. Seuss, pseud.)
Little Toot, by Hardie Gramatky
The Big Snow, by Berta and Elmer Hader
Cock-a-Doyle-Do, by Berta and Elmer Hader
Three Blind Mice, by John William Ivey
Animals of the Bible, by Dorothy Lathrop

or

Who Goes There?, by Dorothy Lathrop
Cock, the Mouse and the Little Red Hen, by Felicité Lefevre
Little Train (or Little Auto), by Lois Lenski
Make Way for Ducklings, by Robert McCloskey
Mittens, by Clare Newberry
When the Root Children Wake Up, by Sibylle V. Olfers
The Christ Child, by Maud and Miska Petersham
The Tale of Peter Rabbit, by Beatrix Potter
Buttons, by Tom Robinson and Peggy Bacon
Chicken World, by E. Royd Smith
The Story of the Three Bears, by Robert Southey
 (This popular nursery tale comes in many editions, usually listed under the name of the illustrating artist)
Koroo the Kangaroo, by Kurt Wiese
The Gingerbread Boy (Old Folk Tale)
 (Sometimes called *The Gingerbread Man* or *The Pancake*)

For other familiar nursery tales for reading aloud, parents will find *The Children's Book* by Horace Scudder a discriminating anthology.

FOR AGES 7 THROUGH 11

Between the ages of seven and eleven, the child's reading interests change rapidly. At seven, the average child still prefers animal picture books; by nine he (more often she) prefers the fairy tales; and by eleven, both boys and girls are starting to read realistic stories of child life and adventure that will engage their attention until their adult interests develop. Parents will know from their own child's development which books from the following list should be selected for the different ages. *Babar*, an exceptionally fine picture book from France, is often enjoyed by children as young as four years; it is usually recommended for children of seven; and it is often given to children of ten. Such realistic stories as *Heidi*, *The Saturdays*, or *The Moffats*, on the other hand, are seldom fully enjoyed until ten years of age and later.

Aesop's Fables, by Aesop and others

These classic stories may be bought in many editions; the one edited by Joseph Jacobs is good. Not all of the fables attributed to the Greek slave, Aesop, originated with him; centuries of retelling have confused authorship—but this is not important to the child reader.

Andersen's Fairy Tales, by Hans Christian Andersen
Forest Pool (ages 10-13), by Laura Armer
Seven Simeons; a Russian Tale, by Boris Artzybasheff
Mr. Popper's Penguins, by Richard and Florence Atwater
In the Days of Giants (Norse Tales), by Abbie Farwell Brown

Alice in Wonderland, by Lewis Carroll (pseud.)
Through the Looking Glass, by Lewis Carroll (pseud.)
Picture Tales from the Russian, by Valery Carrick
Henner's Lydia (10 and over), by Marguerite de Angeli
Babar, by Jean de Brunhoff
Peacock Pie, by Walter de la Mare
Red Folk and Wild Folk, by E. W. Deming
The Saturdays (age 10 and over), by Elizabeth Enright
The Moffats (10 and over), by Eleanor Estes
Poems of Childhood, by Eugene Field
Wind in the Willows, by Kenneth Grahame
House in the Woods and Other Fairy Tales, by J. L. K. and W. K. Grimm
 (There are many fine, illustrated editions of Grimm's *Fairy Tales*)

Mei Li, by Thomas Handforth
Uncle Remus Tales, by Joel Chandler Harris
Augustus and the River (age 9 up), by Le Grand Henderson
English Fairy Tales, by Joseph Jacobs
Jungle Book, by Rudyard Kipling
Just So Stories, by Rudyard Kipling
Wonderful Adventures of Nils, by Selma Lagerlöf
Fairy Book collections (any or all), by Andrew Lang
Little Pear, by Eleanor Lattimore
Rabbit Hill, by Robert Lawson
Strawberry Girl, by Lois Lenski
Story of Dr. Dolittle, by Hugh Lofting
Adventures of Pinocchio, by Lorenzini, Carlo (C. Collodi, pseud.)
Homer Price, by Robert McCloskey
Winnie-the-Pooh (for ages 5-10), by A. A. Milne
Chi-Wee, by Grace and Carl Moon
Holiday Pond, by Edith Patch
Heidi, by Johanna Spyri
East o' the Sun and West o' the Moon, by Gudrud Thorne-Thomsen
Many Moons, by James Thurber
Ake's Ten, by Sjoukje Troelstra
Little House in the Big Woods, by Laura Wilder
Johnny Blossom, by Dikken Zwilgmeyer

FOR AGE 12 AND OLDER

After twelve years of age, sex differences in reading interests become more pronounced. Girls, sometimes maturing two years ahead of boys, may dip into adult fiction, and both girls and boys are ready to sample every known variety of book: biographies, historical narratives, social problems, tales of high adventure and mystery. Girls will read boys' books, but boys seldom care for girls' books. The following list gives a sampling of the classics and the modern tales that have been selected by young adolescents as both enjoyable and educational.

Little Women (for girls), by Louisa May Alcott
Lisbeth Longfrock, by Hans Aanrud
Master Skylark, by John Bennett
Caddie Woodlawn (ages 10-15), by Carol Ryrie Brink
Don Quixote (Barrett or Parry Edition), by Miguel de Cervantes
Odyssey for Boys and Girls, by Alfred Church
Aeneid for Boys and Girls, by Alfred Church
Adventures of Tom Sawyer, by Samuel Clemens (Mark Twain)
Understanding Science, by William Crouse
Silver Pencil (for girls), by Alice Dalgliesh
Daniel Boone, by James Daugherty
The Door in the Wall, by Marguerite de Angeli
Robinson Crusoe, by Daniel Defoe
Christmas Carol, by Charles Dickens
Hans Brinker (ages 9-14), by Mary Mapes Dodge
Leader by Destiny (George Washington), by Jeanette Eaton
That Lively Man, Ben Franklin, by Jeanette Eaton
Matchlock Gun (ages 10-15), by Walter D. Edmonds
Calico Bush, by Rachel Field
One God: The Ways We Worship Him, by Florence Marv Fitch
Johnny Tremain, by Esther Forbes
Abraham Lincoln's World, by Genevieve Foster

Goldsmith of Florence, by Katherine Gibson
Adam of the Road, by Elizabeth Janet Gray
Rolling Wheels, by Katherine Grey
Dark Frigate, by Charles Boardman Hawes
Justin Morgan Had a Horse, by Marguerite Henry
The Singing Sword, by Mark Powell Hyde
Rip Van Winkle, by Washington Irving
Ramona, by Helen Hunt Jackson
Smoky, the Cowhorse, by Will James
Safari, by Martin Johnson
Lassie Come Home, by Eric Knight
Franklin of the Arctic, by Richard S. Lambert
Young Fu of the Upper Yangtze, by Elizabeth Foreman Lewis
Call of the Wild, by Jack London
Trap-lines North, by Stephen Meader
Willow Whistle, by Cornelia Meigs
The Year Without a Summer, by Ethel Parton
King Arthur and His Knights, by Howard Pyle
Men of Iron, by Howard Pyle
Merry Adventures of Robin Hood, by Howard Pyle
Swallows and Amazons, by Arthur Ransome
The Yearling, by Marjorie Kinnan Rawlings
Hoof and Claw, by Charles G. D. Roberts
Jinglebob (Cowboy adventure), by Philip Ashton Rollins
Bambi, by Felix Salten
Abe Lincoln Grows Up, by Carl Sandberg
The Good Master, by Kate Seredy
The Great Heritage, by Katherine Binney Shippen
Downright Dencey (for girls), by Caroline Dale Snedeker
Call it Courage, by Armstrong Sperry
Hunters of the Great North, by Vilhjalmur Stefansson
Treasure Island, by Robert Louis Stevenson
Ballet Shoes, by Noel Streatfeild
The Mitchells, by Hilda Van Stockum
Treks Across the Veldt, by Theodore J. Waldeck
Lost Worlds; Adventures in Archaeology, by Anne Terry White
Swiss Family Robinson, Johann David Wyss
They Loved to Laugh, Kathryn Worth

After 14 years of age, many children show a decline in reading interest. The tempo of life has quickened; hobbies have developed; high school activities absorb interest. Moreover, individual differences in 'teen-agers widen with the years. One 15-year old may read adventure tales with enjoyment, but another may want only books on chemistry or science, and a third may be tempted only by historical narratives. The parents' duty in selecting a child's library is largely completed by the time the child has reached 14. After this age, the discriminating reader whose interests have matured normally will want to select the majority of his own books, but his childhood library will remain a prized possession, re-read throughout his youthful and adult years.

MARGARET LIMA NORGAARD,
 Coauthor, "Children's Reading."

CHILDREN'S LITERATURE, Canadian.—The first Canadian story-book written expressly for children was *Canadian Crusoes* by Catherine Parr Traill, published in 1850. Mrs. Traill (1802-1899), who emigrated to Canada from England with her soldier-husband, wrote the story to tell English children about pioneer life in Canada. Two years later, in 1852, Mrs. Traill's sister, Susanna Moodie (1803-1855), also an emigrant from England, published in book-form *Roughing It in the Bush*, which had previously appeared in a Canadian periodical. Both books were first published in England.

The reasons for Canada's late entry into the children's book field are contained in her history, geography, and economic development. Canada is made up of two racial groups, English and French, divided by language and religion, and without sufficient population in either group to support a publishing industry comparable to that in England, France, and the United States. Therefore, many of Canada's authors have sought publishers—and consequently residence

with eventual citizenship—in those countries where they could find a wider market for their writing.

After Canada's entry into World War I, an aroused national consciousness and pride caused Canadian authors to hold more tenaciously to their own country as a source of literary inspiration. Canada's rugged mountains, sea-swept coastline, historic Hudson Bay region, gentle Acadian valleys, pine-scented forests, and prairie villages awakened a regional literature which librarians, educators, and government fostered, and which caused Canadian publishing houses to grow. With this maturing, there developed a distinguished children's literature, illustrated by Canadian artists, which was truly Canadian in material and treatment. Moreover, wherever its place of publication, Canada began to lay vigorous claim, and rightly, to the output of her native sons and daughters, particularly when the material dealt with Canadian scenes, as much of her modern children's literature does.

To Canada goes the honor of contributing a new pattern to children's stories: a realistic animal story based on natural history and animal psychology. Credit is given to Charles G. D. Roberts (1860-1943) for perfecting the animal tale as an important literary form. His book-length animal stories, the first of which was published in 1896, became world models. Other Canadian writers, preceding Roberts, had used an animal as the central character for a book-length narrative, but had produced work of inferior literary merit, or had oversentimentalized, as did M. Marshall Saunders, a Toronto author, who, in 1900, published *Beautiful Joe*, a dog story that was widely popular and which is still read. In 1898, Ernest Thompson Seton, second only to Roberts in skill as a writer, published *Wild Animals I Have Known* from material collected while he was a government naturalist in Manitoba. Seton produced many distinguished animal stories thereafter. In 1900, William A. Fraser published *Mooswa, and Others of the Boundaries*, a story in the Roberts and Seton tradition. And Grey Owl (Wa-Sha-Quon-Asin), a Canadian naturalist who claimed to be a half-breed Indian born in the United States but who was accused of being a masquerading Englishman, wrote at this same period on wild life and woodcraft. Canadian writers, at the beginning of the century were leading all others in animal and nature stories.

Much history and historical fiction has been written for Canadian children, but the delicately descriptive nature poetry for which Canada's writers are famous, has been directed mostly toward adults.

The mid-20th century trend in Canadian children's literature, as in the United States, has been in the writing of regional stories. *Starbuck Valley Winter* by Roderick Haig-Brown, 1946 winner of the Hébert Medal given by the Canadian Association of Children's Librarians for the outstanding children's book, deals with trappers in British Columbia. *Kristli's Trees* by B. Mabel Dunham, 1948 winner, deals with the Amish and Pennsylvania Dutch settlers in Ontario. Other regional stories of Canada will be found in the booklist following.

In 1946, impetus was given to the production of children's books in Canada by the awarding of special citations and medals. The Canadian Association of Children's Librarians awards a

medal for the outstanding children's book by a Canadian author, with the proviso that it must be published in Canada; and a special citation may be given by the Award Committee for the Governor-General's Medal. See CHILDREN'S LITERATURE for special award winners in Canada.

CHILDREN'S BOOKS BY CANADIAN AUTHORS*

(Published in Canada, England, and the United States)

Ballantyne, Robert Michael. *The Dog Crusoe and His Master* (1860), *Ungava* (1857), *The Young Fur Traders* (1856). Ballantyne, a clerk with the Hudson Bay Fur Company, used his experiences as a basis for adventure tales still read and enjoyed.

Bennett, Ethel Hume. *Camp Ken-Jockey, Judy of York Hill, A Treasure Ship of Old Quebec*. Mrs. Bennett, once a teacher in a Toronto girls' school, wrote conventional girls' adventure stories, but with some poetic feeling, typical of Canadian writers, and with typical Canadian appreciation of natural beauties.

Bice, Clare. *Across Canada, Jory's Cove*. Mr. Bice, a distinguished Canadian artist, illustrated his books with his own water colors; and the United States publisher, Macmillan, gave them an attractive format.

Brown, George W. *The Story of Canada*. Co-authorship: George Brown, Eleanor Harman, Marsh Jeanneret. One of the best of the illustrated books published in Canada (Copp Clark, 1949).

Callaghan, Morley. *Luke Baldwin's Vow*. Morley Callaghan, one of the best-known Canadian novelists and short-story writers, wrote little for children except this one book, but many of his short stories appeal to older children. Mr. Callaghan is typical of the many gifted Canadian writers who are counted native of the United States because their work is published there.

Clay, Charles. *Fur Trade Apprentice, Young Voyageur*. Historical narratives of the fur-trading days around 1775, written by a former teacher in an Indian school on James Bay. Mr. Clay, a Canadian journalist, published his books in England.

Connor, Ralph (see Gordon, Charles).

Cory, Harper. *The Bears of Jasper*. Mr. Cory wrote several factual books about mountain animals.

Daveluy, Marie-Claire. *Sur les ailes de l'Oiseau Bleu. Une révolte au pays des fées*. Fairy tales by a French-Canadian author. This writer has also published six little adventure stories of early days in French-Canada. These are not important works, but are typical of French-Canadian publications: imaginative and with an Old-World flavor.

Denison, Muriel. *Susannah, a Little Girl with the Mountains*. One of a series of books about an adventurous Canadian girl.

Destrois, Mme. Antoinette Tardif (Michelle le Normand, pseud.). *Autour de la maison. La plus belle chose du monde*. Two French-Canadian stories typical of the style and format found in many Quebec publications.

Dickie, Donald J. *Dent's Canadian History Readers* (8 vols. Dent). Together with the author's later book, *The Great Adventure* (1950), the 8-volume histories make good source material, but they are not in format that appeals to children.

Dunham, B. Mabel. *Kristli's Trees*. The C. A. C. L. medal winner for 1949. Miss Dunham's *The Trail of the Conestoga and Grand River* are also rated high by Canadian librarians, but not for children.

Evans, Hubert. *North to the Unknown*. A biography of David Thompson who explored and charted Canada's Northwest. Mr. Evans, an Ontario writer, was a government fish conservationist.

Fraser, William A. *Mooswa*. An animal story popular with Canada's children for half a century.

Garvin, John W. *Canadian Verse for Boys and Girls*. An anthology with biographical notes about each poet.

Gordon, Charles William (Ralph Connor, pseud.). *Glen-garry School Days*. The Rev. Charles Gordon, born in Ontario in 1860, wrote extensively of pioneer life in western Canada. Among his other books also popular with children, although not written for them, were: *Black Rock, The Sky Pilot, The Prospector, The Doctor, and The Man from Glen-garry*.

Grey Owl (Wa-Sha-Quon-Asin). *Sajo and her Beaver People. Tales of an Empty Cabin*. Grey Owl, a Canadian by adoption, wrote extensively on wild life, but *Sajo* is his most popular book with children.

Guillet, Edwin C. *Pioneer Arts and Crafts, Pioneer Life, Pioneer Settlements, Pioneer Travel, Finding New Homes in Canada*. Detailed and illustrated books of historical information, written by a Toronto teacher-historian.

Haig-Brown, Roderick L. *Saltwater Summer, Starbuck*

Valley Winter. Two of the best of the Canadian adventure stories for boys. The first received a special Authors' citation; the second the C. A. C. L. medal for 1946.

Hambleton, Jack. *Forest Ranger, Young Bush Pilot. Abitibi Adventure*. Adventure tales of the forestry service and pulp paper industry, by a Canadian journalist and radio-broadcaster.

Hayes, John F. *Buckskin Colonist, Treason at York*. Historical fiction, by a Toronto businessman-artist.

Hébert, Jacques. *Autour des trois Amériques*. A Montreal publication, in French—a factual account of an overland trip of four young French-Canadians who crossed the American continent.

Heming, Arthur. *The Living Forest, The Drama of the Forests*. Mr. Heming, an outstanding artist, based his two self-illustrated books on his experiences in the Canadian woods while in search of material for his paintings.

Hémon, Louis. *Maria Chapdelaine*, translated by W. H. Blake, illustrated by Thoreau Macdonald. This is a Canadian classic, perhaps the foremost, but more suited to the mature reader than to children. Louis Hémon was a French emigré.

Hooke, Hilda Mary. *Thunder in the Mountains*. Legends and stories from pioneer Canadian days and from Indian tribes, and Eskimos. Mrs. Hooke, born in England, has lived most of her life in Ontario.

Jefferys, Charles. *Canada's Past in Pictures*. Jefferys, an artist-historian, has been called "the foremost authority on Canadian history as it concerns life and customs."

Johnson, E. Pauline. *Legends of Vancouver, Flint and Feather*. Miss Johnson, a distinguished poet, had an Indian father and an English mother. Her Indian name was Takahionwake (Double Canoe). There is a memorial cairn to her memory on Siwash Rock in Vancouver.

Kirby, William. *The Golden Dog*. The first important Canadian novel (1877) using the romantic material of early Quebec.

Lambert, Richard S. *The Adventure of Canadian Painting. Franklin of the Arctic*. The first book contains biographies of Canadian artists, with color reproductions of their work; the second, an historical narrative, received the 1949 medal of the C. A. C. L. as the most distinguished book published in Canada by a Canadian author, for boys and girls; and it also received the Governor-General's medal, the first time awarded to a children's book.

Laut, Agnes C. *Lords of the North, Pathfinders of the West*. Heroic adventures in the early days of the Hudson Bay and North-West Companies. Miss Laut, a Manitoba author, writes of the Selkirk settlers.

Locke, George H. *When Canada was New France*. Dr. Locke, a librarian, collected stories of the French regime in Canada.

McCowan, Dan. *Animals of the Canadian Rockies*, illus. by photographs.

Macmillan, Cyrus. *Canadian Fairy Tales. Canadian Wonder Tales*. Cyrus Macmillan, one-time Dean and Professor of English at McGill University, Montreal, made, in these books, two of the best collections of Canadian folk-tales.

Maillet, Andrée. *Le marquiset têtû. Ristontac*. Two short Montreal publications of exceptional merit, particularly *Ristontac*, the legendary tale of a little Indian.

Montgomery, Lucy Maud (Mrs. Ewen Macdonald). *Anne of Green Gables*. Published in 1908, *Anne of Green Gables* and its successor, *Anne of Avonlea* achieved exceptional popularity with girl readers of many countries. It was widely translated and is still stocked by libraries. Mrs. Macdonald, the wife of a clergyman, wrote other books for girls, but none achieved the fame of the *Anne* books.

Moodie, Susanna. *Roughing it in the Bush*. One of the earliest Canadian stories for children. Mrs. Moodie, born in England in 1803, came to Canada in 1832 with her Army husband. She wrote many books, but *Roughing it in the Bush*, first published in book form in 1852, was the only one to endure. The book was first published in the *Literary Garland*, an early Canadian periodical.

Parker, Sir Gilbert. *The Seats of the Mighty*. An historical narrative. Gilbert Parker, commonly considered an English novelist, was born in Ontario in 1862, and did not leave for England until 1889. It was in England that he did much of his writing, and there he entered politics and was knighted. *The Seats of the Mighty*, published in 1896, is a story of Quebec at the time of Montcalm.

Riley, Louise. *Mystery Horse*. A ranch story with a setting in the Alberta foothills, written by a Canadian librarian.

Roberts, Sir Charles George Douglas. *The Feet of the Furtive, Forest Folk, Kings in Exile, Red Fox, Thirteen Bears, Wisdom of the Wilderness, Hoof and Claw*. These are the best-liked of Roberts' many books on animal life. They are, perhaps, the most significant of

* Approved by Canadian librarians.

all Canadian children's books because they ushered in a new technique: the realistic animal story. Charles Roberts, born at Douglas, New Brunswick, in 1861, was professor of English in King's College, Windsor, N. S. from 1885 to 1895, when he resigned to devote himself to literature. He was a highly imaginative and artistic poet, and his nature poetry is still considered among Canada's best. His animal stories were masterpieces, but his novels dealing with human beings were not so successful. He published 67 books, with three others in preparation at the time of his death. He died in 1943.

Saunders, M. Marshall. *Beautiful Joe*. A sentimental story, written in 1900 to teach kindness to animals. Tremendously popular in its day, it had a wide-reaching influence. *Jimmy Goldcoat*, *My Pets*, and other stories by this author, were less popular.

Seton, Ernest Thompson. *Bannertail, The Biography of a Grizzly*, *The Biography of a Silver Fox*, *The Biography of an Arctic Fox*, *Lives of the Hunted*, *Monarch*, *The Big Bear of Tallac*, *The Trail of the Sandhill Star*, *Wild Animals at Home*, *Wild Animals I Have Known*. Only the chance that Charles G. D. Roberts was a contemporary in Canadian letters prevented Ernest Thompson Seton from being Canada's greatest writer of animal tales. Born at South Shields, England, in 1861, Seton spent his childhood in the forests of Canada and on the western plains. He became official naturalist to the government of Manitoba, and published *Mammals of Manitoba* and *Birds of Manitoba*. An artist as well as a writer, he illustrated much of his own work. Besides his animal stories, he wrote *Two Little Savages*, a somewhat autobiographical story, and *Rolf in the Woods*, which, like his other books, showed his knowledge of camping, hunting, trapping, and animal life. He also wrote manuals of woodcraft and Indian lore.

Skinner, Constance Lindsay. *Beaver, Kings, and Cabins*. Constance Skinner, born in British Columbia at a Hudson Bay trading post, has many novels, poems, and popular juvenile books to her credit. She is now a resident of the United States, where she edited a series called *Rivers of America*, and wrote the volume on the *Missouri*.

Sullivan, Edward Alan. *Brother Blackfoot*, *Brother Eskimo*. Mr. Sullivan, an engineer by profession, an explorer by avocation, gives details of life with the Indians and the people of the Polar regions.

Tait, George E. *The Silent Gulls*. Mr. Tait, an educator, uses the Great Lakes shore life as the theme for this book.

Traill, Catherine Parr. *Canadian Crusoes*. This book, one of the earliest written in Canada for children, was first published in England in 1852; it was republished in Toronto in 1855 under the title: *Lost in the Backwoods: the Female Emigrant's Guide*. In 1923, it was reprinted by McClelland and Stewart, and is still read by Canada's children. Mrs. Traill, a sister to Susanna Moodie (see above), was a botanist and her *Studies in Plant Life in Canada* has also remained on Canadian library shelves. Besides Mrs. Traill and Mrs. Moodie, there was a third writing sister left behind in England when the first two emigrated to Canada with their Army husbands and thereafter adopted Canada as their home. They were all three exceptional women.

Woodley, Edward Carruthers. *Legends of French Canada*. Mr. Woodley, a Montreal churchman and educator, has added to a field that is still open for Canadian folklorists.

MARGARET LIMA NORGAARD,
Coauthor "Children's Reading."

CHILDREN'S PLAYGROUNDS. — RECREATION CENTERS.

CHILDREN'S THEATER. A widespread consciousness of the importance of make-believe in the development of children has gathered tremendous impetus since the turn of the century, and has led to an equally widespread activity in the production of plays by and for children. However, the movement has remained chaotic and unintegrated as regards incentives, ideals, forms, financing, and relations to social and educational thinking.

The children's theater movement is rooted in the inborn desire of children to explore the world about them. As spontaneously as they use taste and touch, children resort to the dramatic imitation of things, animals, people, and situations.

This activity in children has all the urgency of growth, and its satisfactions give corresponding keen delight. Every culture, accordingly, inevitably develops imaginative forms of it: drama, toys, games, rituals, dances, pantomimes, puppetry, pageantry, plays, and theater.

Throughout history two incentives have been influential in shaping these forms. Certain interests seek to use them for their own advantage; others, for the education of children. China, for example, traveling showmen have made a living for centuries by giving street shows for children, who gather at the sound of drum or gong. The troupe often consists of the showman and two boys and a monkey, or a juggler with two or three acrobats. The fact that expenses are met by passing the hat, or charging the small fee that children can pay has conditioned the quality of such entertainment in China, and has almost eliminated the on popular street shows in many other lands at times. The same thing is true of puppetry which flourished all over the Orient after 1,000 B.C., spreading from Egypt to Greece and Rome from Rome to all Italy, and, early in the 17th century, from Italy to all Europe. A 20th century resurgence of interest in puppet theaters for children faced the same problem common to other plays for children, that of combining profit with high quality.

This problem was solved for a time by Shakespeare's day by the master of a boy company which played for two years at the Blackfriars theater in London. The talented and highly trained young actors of this company were unpaid, and their costumes and keep were provided by the court until it was charged that the master, for his own gain, was exhibiting boys "taken" (that is, impressed or kidnapped by royal order for the queen's revels, after which performances were discontinued). However, it is not always for profit that adults exploit the inborn power of children to act. Queen Elizabeth's order to "all mayors, sheriffs, bayliefs, constables, and other officers," enjoining them to observe it "to the uttermost of your powers, as ye will answer to the uttermost of your perylls," stated explicitly that when her agent "takes" any boy, he is to be used in court revels for her "solace." In many other lands and times, children have continued to be dressed and drilled in shows which mean nothing to them except a chance to show off, not for the solace of a queen, but for the pleasure and pride of teacher or parents, or for the benefit of this or that adult interest.

Consciousness of the educational values of dramatic experience by children is as old as the desire to exploit it. Primitive folk have always used dramatic ritual to teach adolescents. In ancient Java, the head of the family used shadow plays to teach the younger generation national history and ideals. Throughout the Christian era, churches, schools, and communities have used Christian plays and pageants for the edification of the young; and commercial theaters in Europe have long offered children folk and fairy plays during the Christmas season.

The first theater founded especially for children was established by the Comtesse de Genlis (1745-1830) at St. Etien, France, in 1782. In that year the countess, a brilliant social success in the amusement-mad top circles of France at

he time, was made *gouverneur* of the children of the duke de Chartres; and she thereafter used her talents primarily in planning and operating a beautiful little theater, training her pupils to appear there in plays which she wrote with the object of inculcating moral and social virtue.

But if the Comtesse de Genlis was the first person to take a children's theater into her own hands, she was far from the last. Inga Björnson, for example, founded the first children's theater in Norway, at Oslo, in 1922, and continued thereafter to carry the finances, rehearse the plays, and persuade Norwegian authors to write folk and fairy plays for her theater. She also organized a children's orchestra to provide music, and her child actors enjoyed real training. Before, during, and after World War II, Antigone Mataxas in Athens, Greece, carried the entire burden of a children's theater, writing and rehearsing the plays, and assuming responsibility for the bills. In Prague, Czechoslovakia, Mila Mellinova drew professional actors into her Theater of Youth (established in 1935), an institution which arranged for the production of a series of 324 fairy tales, and in 1946 visited many towns and cities. This group finally secured its own building, in which children playing children's roles appeared with adult professional actors. In Stockholm, Sweden, Elsa Olenius, stimulated by the disorganization of child life which occurred during World War II, established the first children's theater in her country which was able to give performances with its own decorations and costumes. In New York City, the philanthropist August Heckscher, instead of personally carrying such an enterprise, endowed a foundation "for the recreation, education and welfare of children" which included a children's theater. In London, England, private funds launched The Children's Theatre, Ltd., under the management sponsored by John Christie, organ builder and musical amateur whose productions of opera at Glyndbourne, Sussex, achieved international fame. In addition to giving regular performances, the Glyndbourne management carried plays to schools.

Less striking, but even more dynamic a force in developing plays for children, is the work of groups which have been stirred into action by individual enthusiasts. Hull House, for example, the first settlement house in the United States (established in 1889), was only four years old when a 16-year-old lover of plays and children started a children's theater, since when dramatic work with children has become a recognized part of settlement work. In Palo Alto, Calif., Hazel Robertson was so eager to demonstrate the value of plays for children that she began directing them without remuneration. Within five years the community had provided building, equipment, and salary; and Stanford University shortly thereafter began offering a course in children's theater whose students do field work at the community plant. In Evanston, Ill., Winifred Ward in 1915 persuaded Northwestern University, the city schools, and the community to collaborate in organizing a children's theater, which has sent trained workers to universities and communities throughout the United States. In addition, Miss Ward correlated courses in creative dramatics in the schools and university with her

theater, and convinced a large following that all directors of child actors should understand and apply creative techniques. An outstanding example of what can be done by an aroused group is the work and record of the Junior League in the United States. Stimulated by Helena Adamowski, Junior Leagues began producing occasional plays for children at about the turn of the century. As interest grew, a national association provided a professional field staff which held conferences, interested local institutes, encouraged writers by establishing a manuscript library, pioneered in touring (81 leagues gave 1,016 performances for 445,161 children in 1945-1946), and joined in the efforts to stir universities and communities to action.

From the late 1930's on, the growth in the United States of the whole children's theater field has been amazing. Under the stimulus of the American Educational Theatre, more and more high schools have been producing plays for children; more and more universities have instituted courses in creative dramatics, and children's theaters which they use as "laboratory work" for their courses. Often, following the lead of Northwestern University and Leland Stanford University, these theaters are combined with community efforts. The newly formed American National Theatre and Academy, a tax-free organization chartered by the Congress of the United States as a non-profit enterprise, is giving more and more active support to the children's theater movement as part of its policy of supporting the growth of local theaters all over the country. In 1949 a National Children's Theatre Conference was held in New York City, with ANTA's support in finance and publicity. The fact that ANTA's funds come from citizens all over the United States indicates the vitality of the children's theater movement.

In the United States, the interest shown by universities in children's theaters grew steadily. In 1946 and 1947 the American Educational Theatre Association devoted meetings to the children's theater, discussing among other things its possibility as a field of activity and research for graduate students. Community interest has produced children's theaters too numerous to be listed, and the number has grown steadily. The production by high schools of plays for children has also gained momentum. In Norway, children's theaters have sprung up in many towns. In England the British Drama League established training courses in all parts of Britain in 1946, and puppet shows were shown without charge in the parks of many cities. In St. Gall, Switzerland, the Theater of Marionettes used children from the higher grades to pull the strings of the puppets and to speak the lines. In Ascona, Switzerland, a group of authors, painters, and sculptors established a marionette theater. In Prague, home of the previously mentioned Theater of Youth, the Young Pioneers set up a second theater for young people, where children were also cast in children's roles. In France, Academicians have written health propaganda plays for children. In Tuoule Garden, Copenhagen, Denmark, one-act fairy tales and short puppet ballets are produced for children. At Dryhaven, outside Copenhagen, more complete plays are produced.

Professional and government support of

children's theaters varies considerably throughout the world. In the United States, semiprofessional companies have exhibited children's plays on tour from time to time with limited success. Government help in the United States has been confined to granting tax exemption to a few non-profit organizations.

In Europe, government is much more active in this field. The Soviet Union, which founded the first government-supported professional children's theater shortly after the Revolution in 1917, greatly increased the number, scope, and facilities of children's theaters after World War II. Plays in the Soviet Union reach children everywhere; studios for training designers, writers, and actors existed in every district by 1946. In 1938, 5 of Moscow's 30 theaters, and 140 of the 748 theaters in the country, were operated exclusively for children; according to *Soviet News* (Feb. 20, 1946), 1,400 children's and puppet theaters were in operation in the Soviet Union early in 1946. In the Netherlands, Jungd Toneel, a government-operated traveling professional children's theater takes plays from Amsterdam to schools throughout the country. Admission is 50 cents; if a child lacks the amount, the school pays it. In England, the Council of London, and also educational authorities elsewhere, began cooperating in 1946 with the Glyndbourne management in taking plays produced by the Glyndbourne professional company to schools elsewhere; the schools pay a flat sum and the children see the plays during school hours, without charge. The famous Old Vic Theatre in London added a Young Vic in 1947, both of which operate with the support and sponsorship of The Arts Council of Great Britain. In Mexico, also, government is interested in children's theater. The Ministry of Education sponsors a company at the Palacio de Bellas Artes in Mexico City which casts children in children's roles and gives very elaborate and beautiful productions.

In this world-wide welter of activity, disagreements abound, but certain trends are clear. Emphasis on creative dramatics as preparation for both actors and audience increases: belief is growing that younger children should create their own plays in activities carried on for their own good. At about the 6th or 7th grade children are ready to take part in plays in which they are subordinated to the good of the audience; at all ages they should see plays which are beyond their power to produce themselves. Competent leadership is proving that all aspects of production have great educational value for children. Prizes and other show-off motivations are growingly discounted. It is generally agreed that a juvenile cast may profitably act any play within its imaginative grasp; that an adult cast may profitably act for a juvenile audience any play beyond the ability of children in finish and content, provided it is given in the children's own terms; that a mixed juvenile and adult cast is often but not always most desirable. The proportion of plays written by those who understand both children and the theater, as compared with the trivial output of those who condescend to children, understanding neither, is rising. Systematic research in the nature and needs of a juvenile audience, pioneered by the Goodman Theatre of the Art Institute of Chicago and spreading in the United States and Europe, promises to affect the writ-

ing and production of plays for children more and more. Results of this research emphasize the importance of the unbroken story, the picture-book aspect of the stage, the emotional qualities of voice and movement resulting from power and sincerity in acting, methods of controlling over-stimulation, and the value of carrying meanings to children primarily through action rather than primarily through words. The Soviet Union is using its highly developed children's theater in this fashion, largely for social and political training. At The Hague, in the Netherlands, a group of Rudolph Steiner's disciples bases The Anthroposophic Theater on Steiner's theory that, up to adolescence, education should offer children not moral and intellectual concepts, but organism-as-a-whole experience of the consequences of conduct, dramatized through parable and picture. Many writers and producers are seeking skill in giving the growing personalities of the juvenile audience interpretative experience through the excitement, laughter, and beauty of the plays they absorb so eagerly. Psychiatry's emphasis on the fact that the human organism never really forgets any experience is heightening the consciousness of the importance of children's theater, since what every child experiences at a play becomes a conscious or unconscious part of him for the rest of his life.

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lege Hill Station, Cincinnati, Ohio. Articles on Children's
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New York City. Important articles appear occasionally
in *Theatre Arts*, 130 West 56th Street, New York City.

CHARLOTTE B. CHORPENNING,
Director of Plays for Children, Goodman Theatre, Art Institute, Chicago; Instructor of Playwriting for Children; Author of Plays for Children.

CHILDRESS, Texas, city and Childress
County seat; 106 miles northwest of Wichita
Falls; on the Fort Worth and Denver City Rail-
road; in a cotton, wheat and livestock region,

once part of the OX Ranch. Childress is a trade center and railroad junction. It has cotton gins, and manufactures cottonseed oil, footwear, and meat and dairy products. Pop. (1950) 7,619.

CHILDS, childz, George William, American publisher: b. Baltimore, Md., May 12, 1829; d. Philadelphia, Pa., Feb. 3, 1894. He was a partner in the firm of Childs and Peterson, which in 1856 published Elisha Kent Kane's remarkably popular *Arctic Explorations*, a popularity due in some part to Childs' skillful use of publicity. The Philadelphia *Public Ledger*, which he bought in 1864 in partnership with A. J. Drexel, was the foundation of his considerable fortune. Childs wrote *Recollections of General Grant* (1885) and *Recollections by George W. Childs* (1890).

CHILDS, Marquis William, American journalist: b. Clinton, Iowa, March 17, 1903. He graduated from the University of Wisconsin in 1923 and in 1926 joined the St. Louis *Post-Dispatch*, with which he was associated until 1944. Childs' popular book *Sweden—the Middle Way* (1936) was the result of visits to Europe in 1930 and 1933. It pointed to Sweden as an example of the middle way between uncontrolled capitalism and extreme socialism, describing the Swedish cooperative movements and the public ownership of various natural resources. Later works include *This is Democracy* (1938); *I Write from Washington* (1942); *The Cabin*, novel (1944); and *The Farmer Takes a Hand* (1952).

CHILE, chī'lě, Spanish chē'lá, republic, South America. A country of great natural beauty, Chile is situated on the continent's southwestern coast between the Andes Mountains and the Pacific Ocean. For many years it was considered one of the three ABC powers, with Argentina and Brazil. The word Chile is thought to be derived either from a Quechua Indian word for snow or the Aymará word *Chilli* meaning "place where the earth ends."



Coat of arms.

Chile is bordered on the east by Argentina and Bolivia, on the north by Peru, on the west by the Pacific Ocean, and on the south by Drake Passage. Its geographical configuration, which has been of prime importance in forming a pattern for the country's history, is that of a long, thin, curving ribbon. The total length of the coast is about 2,653 miles. Its width varies from a maximum of 221 miles to about 50 miles. The Chileans, therefore, are naturally directed toward the sea. The total area is 286,396 square miles.

Santiago (known as Santiago de Chile), the capital, has a population of 1,348,283 (1952). The population of the republic according to the census of 1952 was 5,930,809. The basic monetary

unit is the peso. The metric system is the official standard of weights and measures, but the older Spanish units are also widely used.

Chile's flag was adopted in 1817. The lower half is red and the upper half white except for a blue square enclosing a white star in the uppermost corner nearest the staff (see FLAG). The first line of the national anthem, sometimes called *Dulce Patria*, is *Ha cesado la lucha sangrienta* (*The bloody struggle has ended*).

Detailed discussion of Chile is given under the following headings:

The Land and the People

Geographic Zones
Physiography
Climate
Natural Resources
Political Divisions, Chief Cities, and Population

Economic Development

Agriculture and Livestock
Forests
Fisheries
Mining
Industry
Foreign Trade
Currency and Exchange
Finance
Transportation and Communication

Government and Education

Political Organization
National Defense
Labor and Social Welfare
Education

History

Independence
Liberal Era
Congressional Revolt
After World War I

Bibliography

THE LAND AND THE PEOPLE

Geographic Zones.—In addition to the generally lofty Andes, which run along the eastern boundary of Chile, there is the Coastal Range, a parallel ridge along the Pacific coast, of more moderate elevations. Between the two mountain chains, from the Peruvian border to latitude 44° S., lies a longitudinal valley, which in the central section of the country (roughly between Valparaíso and Concepción), where it is called the Central Valley, contains the best agricultural land and the main centers of population. Generally speaking, the northern section of Chile is hot and arid, while the southern portion is cold and wet. As is characteristic of the entire South American Pacific coast, good ports are infrequent.

For convenience of characterization, the republic may be divided into five general zones:

(1) Northern Chile (the "Great" North or Norte Grande), extending from the Peruvian border to the Copiapó River, which reaches the Pacific at about latitude 27° 30' S. in central Atacama Province. Although this region, the Atacama Desert, is without vegetation, except in small areas where irrigation has been established, it is in this region that much of the country's mineral wealth is located, notably the sodium nitrate deposits.

(2) North central Chile (the "little" North or Norte Chico), from the Copiapó to the Aconcagua River, which flows into the ocean 12 miles north of Valparaíso. This zone is less hot and arid. Rain falls several times in the year. Though mining is the chief industry, small areas are also devoted to agriculture.

(3) Central Chile, from the Aconcagua to the Bío-Bío River, which enters the Pacific near Concepción. This zone, the Central Valley, has

a temperate climate and fairly abundant rains. Cattle raising, mining, and the cultivation of cereals, vines, and fruits are the leading industries.

(4) South central Chile, from the Bio-Bio to Puerto Montt. Here rains are more abundant and the climate cooler. The chief products are wheat, cattle, and lumber.

(5) Southern Chile, from Puerto Montt to Cape Horn. This zone is cold and rainy. From latitude 43° 30' S. southward for about 1,150 miles is a district of islands and uplands, rich in forests, fisheries, and lands suitable for stockraising.

On the Strait of Magellan is Punta Arenas, capital of Magallanes Province, the southernmost city of the world. Center of a ranching and lumbering region and situated on an important shipping route, it is a thriving, modern city of 34,440 inhabitants. Except for outlying islands, Magallanes terminates on the southeast in the Chilean half of Tierra del Fuego. The eastern half of Tierra del Fuego, belonging to Argentina, separates Magallanes from the Atlantic, but Chilean control of both sides of the Strait of Magellan provides it for all practical purposes with an outlet on that ocean.

Chile claims the section of the Antarctic lying between longitudes 53° W. and 90° W., parts of which are also claimed by Argentina and Great Britain.

West of the Chilean mainland, at distances ranging from 400 to more than 2,000 miles, are a number of islands under Chile's control. Among these are the following (with their approximate distances from the Chilean coast): Juan Fernández Islands (400 miles), on one of which, Más a Tierra, lived Alexander Selkirk, the prototype of Robinson Crusoe; San Ambrosio Island (600 miles); San Félix Island (600 miles); Sala-y-Gómez Island (2,000 miles); and Easter Island (2,300 miles).

Physiography.—The country is essentially a valley enclosed between two ranges of mountains. On the east are the Andes, diminishing in height to the south, where their line is crossed by various rivers and lakes. On the west, a lower parallel range, the Coastal Range, is interrupted at about 42° south latitude by many fjords. The longitudinal valley, admirably fertile between the Aconcagua and Bio-Bio rivers, begins in the arid desert of the north and ends submerged in the ocean in the south. Known as the Central Valley, this plain extends for about 600 miles.

The Coastal Range is geologically older than the Andes. It is lower and less continuous, with an abrupt slope to the west, while sinking much more gradually to the east. In Tarapacá it rises almost from the sea to heights varying from 1,000 to 7,000 feet. In Atacama it averages 3,000 feet, reaching its highest peak in Cerro Colupo (7,000 feet). Farther south it recedes from the sea and sinks in height until it disappears below Tres Puntas, a mining center in Copiapó. It rises again to some 7,000 feet in the central provinces, notably in the peaks of Roble and Campana, near Valparaíso. South of the river Rapel the range becomes lower and more irregular. Farther south it splits into two parallel low spurs. South of the Bio-Bio River it is known as the Cordillera de Nahuelbuta. Still farther south both the range and the parallel valley plunge into the sea. But its peaks and high plains form the line of islands clinging to the curved shoreline, though only at one point, the

Taitao Peninsula, is it visibly united to the continent.

The Andes chain, with many peaks of over 20,000 feet, contains mountains second in height only to the Himalayas. Southeast of Antofagasta, Lullaillaco rises to about 22,000 feet; east of Valparaíso just over the Chilean border is Aconcagua (about 23,000 feet), the highest peak in the Western Hemisphere; and east of Santiago, on the border, is Tupungato (about 22,000 feet). Farther south, in the region northeast of Puerto Montt, the snow-capped volcanoes Llaima and Villarrica, white, cone-shaped Osorno, with emerald Lake Todos los Santos at its foot, El Tronador ("the thunderer"), named for the avalanches which plunge down its slopes, blue glacial lakes, and virgin forests make the breathtakingly beautiful scenery which has earned for Chile the name "Switzerland of South America."

The smaller hydrographic system of the country is formed by rivers that rise on the western side of the Coastal Range. The rivers of the larger hydrographic system, source of unlimited power for industrial uses, begin high in the Andes, descending to the Pacific coast in a series of cascades and great waterfalls.

The only river north of the Copiapó, generally considered the southern limit of the Atacama Desert, which carries its waters to the ocean for more than a few months in the year is the Loa in Antofagasta Province. In the region just south of this, to latitude 35° S.—and particularly in the Valparaíso-Santiago section—rivers are supplied by rains that fall on their watersheds, and are swollen in the warm months of November to February by the snow melting in the mountains. These annual floods bring alluvial silt down into the agricultural valleys to renew their fertility. South of latitude 35° S., however, the rivers are more often subject to floods during June and July than from November to February, since the melting of mountain snow affects the total volume of water much less in these latitudes. Navigable rivers are comparatively few, and in any event they would be called upon to play a less important role in Chile than are the great inland waterways of Argentina and Brazil, since the ocean itself facilitates communication with, or between, the different parts of this narrow country.

Above the southern limits of the arid zones there are saline depressions in lieu of lakes, although in remote ages, before radical changes in climatic conditions occurred, the lake region embraced these northern districts. Lakes are numerous in the south and are often found at imposing elevations.

Climate.—Being in the Southern Hemisphere, Chile has seasons which are the reverse of those in North America. Since its territory extends from subtropical to Antarctic latitudes and from sea level to the highest peak in the Western Hemisphere, it would naturally have many varieties of climate. The cold Humboldt (or Peruvian) Current, which reaches Chiloe Island and thence flows northward to the equator, has a marked effect on the climate of the coast, making the temperature 6° to 7° F. lower than normal for the latitude. Prevailing winds and high altitudes have the same effect upon the climate of the interior. Cold, stormy winters are found in the far south toward Tierra del Fuego, but extremely low temperatures are rare except in the year-round snow-capped peaks of the Andes.

Throughout the central area the climate is temperate. Here mild, wet winters average a low temperature of about 37°F., seldom dropping below freezing. Hot, dry summer days average 84°F.

Differences in rainfall are greater than those of temperature. The northern desert region may go for years without any rain at all, while rain is abundant in the Central Valley and very heavy in the southern (Patagonia) region.

Natural Resources.—The essential characteristics of Chilean flora were given to it during the long prehistoric ages of complete isolation before the Argentine pampas were lifted out of the waters that covered them. Even now the country is shut in by the Andes on that eastern side, and on the north it is cut off from the rest of the continent by deserts. Formerly its isolation was like that of a Pacific island, and naturally it is distinguished botanically by a large number of indigenous species. Among these are several species of *Francoa* and cactus. The hard espino, a species of acacia from which charcoal is made, is found throughout the Central Valley, as is the Chilean pine or *piñón*, the nut of which is highly valued. Chile's national flower, the copihue (*Lupageria rosea*), a lovely red lily about one and one-half to three inches long, grows everywhere in the same region. South of the Bio-Bio River, where the true forests begin, are found the commercial woods, such as laurels, magnolias, various species of conifers, and a variety of beeches. The potato is said to have come originally from Chile. It is still found wild in Chiloe and the adjacent islands and mainland. The bean and peppers are also indigenous, and corn (maize) and quinoa were grown in the country before the Spanish conquest.

The fauna also differs from that of other South American countries to the extent of excluding jaguars, venomous snakes, monkeys, lizards (save in the northern zones), and river turtles. There are 12 genera and 25 species of rodents. In this order are included the beaverlike coypu and the chinchilla, both valued for their fur. Among Carnivora are the wildcat, puma, and fox. Characteristic ruminants are the guemal deer and the small pudu (the latter peculiar to Chile), and those wild members of the llama family, the vicuña and guanaco. Birds, great and small, are the condor, albatross, pelican, giant fulmar, penguin, rhea (South American ostrich), cormorant, barking bird, turco, tapacolo, gull, swan, duck, parrot, and three species of hummingbirds (one peculiar to Chile).

Fish, comparatively rare in the rivers, abound in the ocean near the coast and in the channels of Magallanes Province, and are taken in great numbers in the northern harbors. Chilean waters are also visited by whales and at least six species of seals.

The country's mineral wealth lies mostly in Chile's northern zone. For the uses of mineral resources, see the section *Economic Development*—*Mining*.

Political Divisions, Chief Cities, and Population.—The official census figures for the population of Chile were 3,753,799 for 1920, 4,287,445 for 1930, 5,023,539 for 1940, and 5,930,809 for 1952.

Both birth and death rates are high. The Chilean birth rate was 39.8 per 1,000 inhabitants in 1930 and averaged about 33 per 1,000 during 1950-1952. The death rate declined from 33

per 1,000 in 1923 to about 15 per 1,000 in 1950-1952. The density of population averages somewhat more than 20 persons to the square mile, but more than three fifths of the inhabitants are concentrated in the central region comprising only one fifth of the total area of the republic. In large parts of the northern desert and semi-desert region the average is only about four persons to the square mile, while in the southern provinces of Aysen and Magallanes it is only about one person to the square mile. The distribution of the population by provinces is shown in the accompanying table. The provinces are listed in order of their position from north to south.

Prov	Square miles	Population (1952)	Inhabitants per square mile
Tarapacá	21,346	102,789	4.8
Antofagasta	47,515	184,779	3.9
Atacama	30,843	80,154	2.9
Coquimbo	15,401	262,067	17.0
Aconcagua	3,940	128,378	32.6
Valparaíso	1,860	498,186	267.8
Santiago	6,727	1,752,773	260.1
O'Higgins	2,746	224,637	81.8
Colchagua	3,255	139,531	42.9
Curicó	2,215	89,391	40.4
Talca	3,722	173,793	46.7
Linares	3,792	146,257	38.6
Maule	2,172	72,181	33.2
Ñuble	5,487	251,607	45.8
Concepción	2,201	411,559	187.0
Arauco	2,222	72,289	32.5
Bio-Bio	4,342	138,411	31.9
Malleco	5,512	159,486	28.9
Cautín	6,707	365,072	54.4
Valdivia	8,083	232,647	28.8
Osorno	3,507	123,059	35.1
Llanquihue	7,107	139,922	19.7
Chiloe	9,053	100,401	11.1
Aysen	34,357	26,262	0.8
Magallanes	52,284	55,091	1.0
Antártida ¹		87	
Total	286,396	5,930,809	20.7

¹ Antarctic territory claimed by Chile.

While the majority of Chileans are of European (chiefly Spanish and Basque) origin, there is a considerable infusion of Indian (Araucanian) blood, especially in the laboring class. British, Irish, German, and other European nationalities have mixed with the largely Spanish upper and middle classes. Remnants of three aboriginal Indian races remain. In the extreme south live the Fuegians, who are mostly nomads. In the valleys and Andean mountain slopes of south central Chile are nearly 100,000 Araucanians. Inhabiting the northern coast region are the Changos, who perform much of the rough labor in mines and nitrate fields.

Immigration into Chile in recent decades has been relatively small. Immigrants exceeded emigrants by an average of about 4,500 annually during the years 1949-1951. Germans and Spaniards made up the largest proportion of immigrants after 1930.

The chief cities, with population figures from the 1952 census, are: Santiago, the national capital, 1,348,283; Valparaíso, 218,829; Concepción, 119,887; Viña del Mar, 85,281; Antofagasta, 62,272; Talca, 55,059; Talcahuano, 54,782; Chillán, 52,576; Temuco, 51,497; Valdivia, 45,128; Osorno, 40,120; Iquique, 39,576; Punta Arenas, 34,440; Puerto Montt, 28,944; and Curicó, 26,773.

ECONOMIC DEVELOPMENT

Chile's principal economic activities received marked stimulus during the 1930's and 1940's, and

were undergoing continued rapid development in the 1950's. The great emphasis laid upon industrialization, however, has caused some disequilibrium in the economy, aggravated by constant inflation. Mining continues to produce sufficient foreign exchange to cover a substantial part of the imports of raw materials and foodstuffs.

In 1950, according to the Corporación de Fomento de la Producción, industry contributed 23 per cent of the total national income, agriculture about 16 per cent, and mining less than 10 per cent. At the same time the gainfully occupied population included 33.5 per cent in agriculture, 20.6 per cent in industry, 9.3 per cent in trade and finance, 4.8 per cent in transportation and public utilities, 4.6 per cent in public administration, 3.9 per cent in mining, and 23.3 per cent in services.

Agriculture and Livestock.—Land suitable for agricultural and pastoral purposes was estimated at 12.7 million hectares in 1952. (One hectare equals 2.471 acres.) About half this area (6.8 million hectares) is under pasture, and 2.7 million hectares are fallow in natural grasses. The remaining 3.2 million hectares are under cultivation, mostly in cereals (about 80 per cent). It is estimated that about 60 per cent of the Chilean territory is not suitable for agricultural, pastoral, or forestry purposes. The low amount of land suitable for cultivation poses a serious problem for agricultural development. This problem has been aggravated by improper land use, caused mainly by an improper land tenure system—over 90 per cent of the arable land remains in the hands of less than 5,000 proprietors. The remaining 10 per cent is distributed among over 200,000 small farmers.

The principal agricultural region of Chile extends from slightly to the north of Valparaíso to Valdivia in the south central part. This includes the Central Valley, one of the garden spots of the world. The three leading crops are wheat, barley, and oats. Rice, corn, beans, peas, lentils, potatoes, onions, garlic, fruits, and nuts are also produced. The principal fruits are apples, melons, and grapes. These are shipped to the New York market from Valparaíso during the winter months in the United States. Chilean wines are exported not only to all parts of the Western Hemisphere but also to Europe. Nearly 80,000,000 gallons were produced in 1950. A great variety of vegetables is grown and large quantities of beans, peas, lentils, chick-peas, and onions are normally exported. Chile produces enough cotton to supply one third of the requirements of her cotton mills. Other crops are alfalfa, clover, beet and cane sugar, and tobacco.

The livestock industry is an important one. Wool, hides, and skins, and fresh and frozen meats are the chief products. In 1946, 193,832 metric tons of beef and veal, 55,137 of mutton, 25,160 of pork, and 1,320 of goat meat were processed. Wool production runs around 20,000 metric tons annually. About two fifths of the flocks are grazed in the southern province of Magallanes. Cattle raising is largely for the domestic market, although considerable quantities of cattle hides are exported.

Forests.—Chile's main forested area lies in the southern part of the country between latitudes 37° S. and 44° S. The state owns about one half of the forest lands, which cover one fifth of the entire country. The principal trees from which lumber is produced are the roble, laurel, coigue, pine, and eucalyptus. The total fellings of conifer-

ous and broad-leaved woods in 1951 were 2,290,000 cubic meters for industrial purposes and 3,300,000 cubic meters for fuel, including wood for charcoal.

Fisheries.—Some 93,000 metric tons of fish, crustaceans, and mollusks were caught in 1951. The coastal waters abound in over 250 varieties of fish, including haddock and sole. There are also excellent oysters, lobsters, and anchovies. The whaling industry is carried on from Corral, Talcahuano, and Punta Arenas. The catch totaled 33,105 metric tons in 1950.

Mining.—Minerals account for over three fourths of the value of all Chilean exports, and create approximately one half of the foreign exchange available for the purchase of imports. The northern part of Chile depends almost entirely upon mining industries, and the agricultural and industrial sections of central Chile are to a considerable extent employed in producing for the northern mining region. Thus, in addition to some 89,000 workers directly employed in mining in 1950, the economic influence of the industry was felt throughout the republic.

Of the total exports in 1950, copper accounted for 51 per cent by value, and sodium nitrate and its byproduct iodine for more than 22 per cent. Copper was the leading export before the rise of the nitrate industry in the 1880's, and it regained this position in 1932. Chile remained the world's leading producer of copper until 1881, when it was supplanted by the United States; since then it has generally maintained second place. Among the South American countries, Chile is perhaps the richest in mineral resources, ranking first in the production of copper, nitrates, and coal, and high in production of iron ore. The coal output is all consumed in Chile. Practically all the other minerals are exported, chiefly to the United States. They include gold, silver, lead, tungsten, molybdenum, bismuth, manganese, mercury, aluminum, and zinc. Production of the principal minerals in 1913, 1929, 1939, and 1951 is shown in the accompanying table. The figures are for metric tons, except as noted.

	1913	1929	1939	1951
Metals				
Copper, ¹ tons	42,203	320,600	304,494	379,726
Silver, ¹ kilograms	39,564	48,843	41,287	30,590
Gold, ¹ kilograms	1,147	806	11,492	5,402
Iron ore, 1,000 tons	14	1,809	1,626	3,174
Manganese ore, tons	...	3,000	12,550	
Nonmetals				
Nitrate, ² 1,000 tons	2,722	3,280	1,427	1,684
Sulphur, tons	6,647	16,300	27,432	22,000
Coal, 1,000 tons	1,283	1,508	1,838	2,211
Cement, 1,000 tons		145	268	699

¹ Including content of fine metal in ores and concentrates exported.

² The fiscal year, ending June 30 of year listed.

³ Figure not available.

In 1951 Chile produced 16 per cent of the total world production of copper. The copper mining industry is controlled largely by United States capital. The copper deposits occur in the Coastal Range and in the lower slopes of the Andes in both northern and central Chile. Over 90 per cent of the total output comes from three large mines: the Chuquicamata, owned by the Chile Copper Company; Potrerillos, owned by the Andes Copper Mining Company; and El Teniente, property of the Braden Copper Company.

The exploitation of the great sodium nitrate deposits in the northern desert played a key role in the development of Chile after their ac-

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quisition from Bolivia and Peru in the War of the Pacific (1879-1884). Until the development of the synthetic nitrate process, Chile enjoyed a virtual monopoly of this valuable mineral. Exploitation of the deposits began commercially about 1831, but it was not until after 1881 that the industry attained great importance. In 1880 the Chilean government imposed an export tax on the rapidly increasing shipments of nitrate. The tax yielded a total of 7,981,000,000 pesos, or nearly \$1,000,000,000, during the years 1880-1930. This was 43 per cent of the ordinary revenues of the government for that period. The nitrate industry, and the steady, substantial income it brought the government, was responsible in large measure for the temporary emergence of Chile as one of the richest and most powerful countries of South America.

In 1889 Chile supplied almost all the world's nitrate, but by 1913 production of the cheaper synthetic product had reduced Chile's share of the world production to one half, by 1918 to about one third, by 1929 to less than one fourth, by 1938 to about one twelfth, and by 1953 about one twentieth. During the years 1914-1918, nitrate exports averaged 2,528,000 metric tons, valued at \$125,793,000. In 1920 they reached 2,746,000 metric tons, valued at \$144,957,000. During the world economic depression of 1929-1934, exports declined. They were only 244,000 metric tons, valued at \$5,361,000, in 1932. This resulted in the virtual elimination of the government's income from the nitrate export tax and led in 1934 to the establishment of a state monopoly. The Nitrate and Iodine Sales Corporation, controlled but only partially owned by the Chilean government, was established to fix annual production quotas and to determine the share of each of the producing companies. The government receives 25 per cent of the gross profits of the corporation. Nitrate production in 1951 was 1,684,000 metric tons.

The mining of coal on a commercial scale began about 1840. Production has increased to over 2,000,000 metric tons annually as a result of tariff protection and other governmental aids. The deposits lie along the coast from latitude 36° S. to the Strait of Magellan. The principal mines are located at Coronel, Lota, Curanilahue, and Lebu.

Iron ore is Chile's most important industrial metal after copper. It has been produced chiefly by the American-owned Bethlehem Chile Iron Mines Company since 1913. Large-scale production began in 1922. Large deposits of high-grade ore are available close to the seaboard, where ore can be shipped by low-cost water transportation. The deposits are confined to a well-defined belt running along the western third of the provinces of Coquimbo, Atacama, and part of Antofagasta. The internal production and consumption of this mineral has increased with the development of a domestic iron and steel industry since 1951.

The exploitation of Chile's natural sulphur deposits on a large scale date from about the beginning of this century. Average annual production during 1934-1951 was about 23,000 metric tons.

Gold, mined in considerable quantity during the 18th century, experienced a marked increase in production in 1929-1934 during the world economic depression and the accompanying increase in gold prices. Production in 1951 was 5,402 kilograms.

The Chilean mining industry was hard-hit by the depression of 1929-1932. The general index

of mineral production in 1932 was barely one fourth that of 1929. Since 1936-1938, however, it has slowly recovered. Using this last period as a base, the general index of mineral production was 120.8 in 1942, but only 113.4 in 1951. Employment in the mining industry dropped from 91,000 before the world depression to 38,000 in 1932, but increased to 89,000 by 1950.

Industry.—Chile is one of the leading industrial nations of South America. In spite of difficulties caused by the limited local market and the lack of raw materials and sufficient electric power, its industrial development has gained momentum since 1951, when the steel plant at Huachipato, near Concepción, began production under the auspices of the governmental Corporación de Fomento de la Producción. In that year the plant produced some 220,000 metric tons of cast iron, 178,000 tons of steel ingots, and 279,000 tons of laminated products. These figures were surpassed in 1952 (247,558 tons of cast iron, 242,591 tons of steel ingots, and 386,000 tons of laminated products), and it was estimated that the plant would make even greater gains in 1953. This steel production, augmented by older plants at Valdivia and Santiago, favors the expansion of existing industries and the founding of new ones.

Railway cars are manufactured in Chile, and airplanes are assembled at a Curtiss-Wright branch factory. Three plants with an annual capacity of over 100,000 automobile tires operate under United States trade names. The country has three large cement plants, which supply all the domestic demand. In addition, Chile supplies all its own requirements of woolen textiles, pharmaceutical and toilet articles, shoes, paper (except newsprint), explosives, wood products, and tobacco products. It produces a substantial share of the paint, cotton textiles, and industrial chemicals needed. Vegetable oils, beverages, clothing, knit goods, sanitary fixtures, cordage, building products, and printed matter are other important products. Chile leads the world in the production of iodine, a byproduct of the nitrate industry.

Foreign Trade.—As is the case with most Latin American countries, Chilean foreign trade rests upon the exportation of a few products, in this case copper and nitrates, which together account for over 75 per cent of the total value of exports. The remaining 25 per cent is made up chiefly from the exportation of a few agricultural products (beans, peas, lentils, barley, hemp fiber, hides, rice, wines, and fruits), iodine, and iron ore. In exchange for these, Chile obtains industrial and agricultural machinery and equipment, some raw materials for native industries, crude petroleum, gasoline, and consumer goods, mainly foodstuffs, textiles, home appliances, automobiles, rubber articles, and luxury items.

Throughout the 1940's Chile managed to maintain an export balance in foreign trade. To attain this objective, severe import restrictions had to be imposed by the government. Exports in 1950 amounted to \$293.8 million, which represented a 103 per cent increase over the 1938 figure. Imports amounting to \$247.9 million had increased 140 per cent in 1950 as compared with 1938, the year that Chilean trade began to recover from the depression of the 1930's, which hit the country very hard.

The trend of Chilean foreign trade for selected years since 1913 is shown in the accompanying table.

The United States is Chile's main supplier and

	Imports	Exports
	(Values in thousands of U.S. dollars)	
1913	\$120,274	\$142,802
1929	196,858	279,146
1932	26,018	35,353
1938	103,035	141,010
1945	156,122	210,699
1946	196,934	229,983
1947	269,892	280,043
1948	270,400	329,907
1949	304,583	308,337
1950	247,958	293,794

customer, but Argentina, Brazil, and Peru do a sizeable volume of business with Chile. Great Britain, France, Germany, and Italy are Chile's leading European foreign traders.

Currency and Exchange.—After struggling for many years with the problem of a widely fluctuating inconvertible paper currency, the Chilean government in 1925 accepted the recommendations of an American financial mission headed by Professor Edwin Walter Kemmerer of Princeton University and placed the country on the gold standard. Previously the peso, nominally worth \$0.3650 at par, had fluctuated at \$0.18 to \$0.25 on the exchange market. A decree of September 1925 fixed the gold content of the new peso at 0.183057 grams (fine), equivalent to 6 pence sterling or \$0.1217 on the basis of the United States gold dollar and to \$0.2061 on the basis of the currency dollar as revalued in 1934. The gold peso is still used in compiling import and export statistics and in levying tariff duties and certain other taxes.

The value of the paper peso fluctuated widely after Chile abandoned the gold exchange standard in 1931. Its official exchange value is regulated in accordance with the law of April 19, 1932, which authorized the Central Bank to determine international exchange rates. Immediately thereafter the official rate was fixed at 3 pence gold and was maintained at that level until Jan. 2, 1935, when the basis was changed to 1½ pence gold, or \$0.0516 in United States currency; that is, \$1.00 was equal to 19.37 Chilean pesos. As a result of this and other exchange measures adopted by the Central Bank, and of compensation trade agreements concluded with various European countries, four additional exchange markets developed (export draft, curb, free, and gold exchange markets), each quoting exchange at different rates. The true value of the paper peso for foreign commercial purposes was the rate existing in the free, or unofficial, exchange market. Governmental measures taken between 1939 and 1952 established different rates of exchange, according to the purpose for which it was used. In 1950 there were seven exchange rates for the Chilean peso. The average annual values in relation to the United States dollar are shown in the accompanying table.

AVERAGE ANNUAL EXCHANGE RATES OF THE CHILEAN PESO
(Pesos per dollar)

Selling rates	1947	1948	1949	1950
Government	19.37	19.37	19.37	19.37
Preferential	25.10	25.10	25.10	—
Official	31.10	31.10	31.10	31.10
Banking market	—	43.10	43.10	43.10
Provisional commercial	—	—	—	60.10
Special commercial	—	—	—	50.00
Curb or free	47.89	66.66	79.00	91.04

The depreciation of the internal value of the peso has created great disturbances in the Chilean economy. The free rate of exchange dropped from 91.04 pesos to the dollar in 1950 to 220 pesos to the dollar at the end of 1953, when the official rate was 110 pesos per dollar. The purchasing power of the peso in 1950 was one fifth of its purchasing power in 1940.

Finance.—The Central Bank (Banco Central) of Chile is under government control. It was established on Jan. 11, 1926, to serve as the sole note-issuing agency, to regulate general credit, and to supervise banking operations. The bank's credit operations as of Dec. 31, 1952, amounted to 15,513 million pesos,¹ distributed as follows:

(Millions of pesos)	
Loans to the government	5,710
Loans to official institutions	3,950
Loans to the public	2,470
Loans to banks	4,090
Other operations	— 707
Total	15,513

The gold and foreign exchange reserves of the bank were \$67.0 million in December 1952 as compared with \$110.0 million in December 1945. Dollar exchange held in foreign countries by businesses and individuals amounted to \$29.1 million on Dec. 31, 1952.

Government expenditures have run higher than government revenues in Chile, and both have increased tremendously since 1946, as can be seen from the accompanying table based on information released by the Ministry of Finance.

GOVERNMENTAL REVENUES AND EXPENDITURES

	Revenues	Expenditures	Pesos per U.S. dollar ¹
	Millions of pesos		
1940	2,698	2,925	33.90
1946	7,674	9,039	39.50
1947	11,837	12,471	50.93
1948	15,642	14,739	65.55
1949	16,621	16,636	99.08
1950	18,824	22,269	72.50
1951	27,255	29,612	92.60
1952	33,394	43,656	128.50

¹ Free exchange rate, end of years.

Chile's revenue structure is based principally on indirect rather than on direct taxation. In fact, more than 60 per cent of the revenues derived from taxation originate in indirect taxes. Custom duties and import and export taxes are other major sources of revenue. Government borrowing from the Central Bank and from other sources is required to cover government expenditures which cannot be covered by the ordinary revenues. The internal debt on Dec. 31, 1950, amounted to 5,090 million pesos.² The external debt of the same date was as follows:

In pounds sterling	21,735,522
In United States dollars	114,791,000
In Swiss francs	93,297,000

The service of the foreign debt was resumed in 1948; it had been suspended in 1935.

Transportation and Communication.—The highways of Chile in 1951 aggregated 50,267

¹ Free exchange rate, end of 1952, 128.50 pesos per U.S. dollar.

² Free exchange rate, end of 1950, 72.50 pesos per U.S. dollar.

kilometers, 43,523 km. of which were improved types. Automotive vehicles in the same year numbered 78,610, of which 43,390 were automobiles. The Chilean section of the Pan American Highway runs from the Peruvian border in the north, into the Central Valley, and then east across the Andes to Uspallata Pass on the frontier with Argentina. Although the road over the pass is blocked during the winter season, automobiles may nearly always use the railroad tunnel below.

The government-operated airline, Línea Aérea Nacional, links Santiago with Arica in the north and with Puerto Montt and Punta Arenas in the south. International air systems connect Santiago with the chief cities of South and North America and Europe.

Chile had some 6,635 miles of railway lines in 1948, of which about two thirds were state-owned. The state lines connect Pisagua, the northernmost nitrate port, with Puerto Montt in the south. Branch lines extend to the chief ports and the principal towns of the interior. An electric express connects Valparaíso and Santiago. There are four trans-Andean railway routes: Arica to La Paz, Bolivia, opened in 1913; Antofagasta to Uyuni (Bolivia) and Buenos Aires; Antofagasta to Salta (Argentina) and Buenos Aires; and Valparaíso to Mendoza (Argentina) and Buenos Aires. The Andes may also be crossed by a combination route: by rail from Santiago to Osorno in the south, then by lake steamer and automobile to Bariloche, Argentina.

Chile's extremely long coastline makes coastwise steamer transport very important. All ports are served by Chilean vessels. There was a gross registered tonnage of 169,000 in 1950. One Chilean steamship line connects Chilean ports with New York via the Panama Canal and with Europe via the Strait of Magellan.

Other communication facilities include about 15,800 miles of telegraph lines (10,700 miles government-owned); some 5,000 miles of telephone lines serving 137,700 telephones (1952) and connecting all the Chilean cities; radiotelephone and cable services to the countries of Europe and North America; an extensive wireless telegraph system that provides the chief means of communication for the isolated southern provinces; and more than 75 radio broadcasting stations. There are approximately 1,150 post offices handling about 100,000,000 pieces of mail annually.

GOVERNMENT AND EDUCATION

Political Organization.—Chile's constitution was promulgated on Oct. 18, 1925. It provides for a republican form of government; executive, legislative, and judicial branches; separation of church and state; religious freedom; and social welfare as a function of the state.

Under it the president is the chief executive, and is elected by direct popular vote for a term of six years. He may not immediately succeed himself. The president appoints his cabinet, officials of the ministries, diplomatic agents, intendants, governors, magistrates of the higher courts of justice and some inferior courts, and other civil and military employees. The cabinet ministers may attend sessions of the legislature and take part in deliberations, but may not vote.

The chief governmental authority in each province is vested in the intendant as the agent of the president. The intendant is advised by provincial assemblies. The provinces are subdivided

into departments administered by governors, then further subdivided into communes governed by mayors, who, like the governors, are appointed by the president. These mayors are aided by elected aldermen or *regidores*.

The National Congress is composed of two branches, the Chamber of Deputies and the Senate. Deputies are elected by departments, or by groups of adjoining departments within each province, one deputy for each 30,000 inhabitants or fraction of not less than 15,000. The Chamber is renewed every four years. It alone may bring accusations against the president and other officials. Senators are elected in nine provincial groups, five senators to each group, each for a term of eight years. Provision is made to renew the Senate in part every four years. A two-thirds vote of both chambers is necessary to pass bills over the presidential veto.

A Supreme Court at Santiago is provided for, as well as courts of appeal, tribunals of first instance, and lesser courts throughout the republic. Supreme Court justices are appointed by the president from a list submitted by the court. The Chilean civil code, which was prepared by Andrés Bello and went into effect in 1857, is still essentially in use, although modified and amended. A model of scientific legislation, it includes the subjects of persons, property, obligations, contracts, domestic relations, successions, and inheritance. Additional legislation in the fields of commercial, administrative, criminal, and labor law also governs the country.

Chilean citizens 21 years of age or over who can read and write and are registered are entitled to vote in all elections. Women, and foreigners resident in Chile for five years, may vote in municipal elections.

National Defense.—Under the Chilean compulsory military service system, youths are called to the colors at the age of 20, usually for a year and a half. They then serve for 12 years in the active army reserve and for the next 11½ years in the second-line reserves. The army is organized in three army corps and one army division, one cavalry division, and a railway regiment. In 1948 there were 1,900 officers and 18,500 men.

The principal vessels of the Chilean Navy are the battleship *Almirante Latorre* of 28,000 tons displacement, launched in 1913, but refitted and remodernized, and the 10,000-ton cruisers *Capitán Prat* (launched in 1937) and *O'Higgins* (1936), formerly the *Nashville* and *Brooklyn*, purchased by Chile from the United States in 1951. The navy also has destroyers, submarines, and various smaller craft. Naval personnel normally numbers about 13,000. There is a naval academy at Talcahuano near Concepción.

Labor and Social Welfare.—Urban labor in Chile enjoys some of the Western Hemisphere's most advanced legislation relating to low-cost housing, social security, and accident insurance. The groundwork for this legislation was laid during the administration of President Arturo Alessandri in a series of labor laws, which, although not adopted by Congress immediately, formed the basis of other laws passed in 1924 relating to labor contracts, arbitration tribunals, and accidents at work. Additional laws and decrees were aimed at extending social security and retirement benefits to employees of private industry and to persons in the professions. In 1945 all provisions of previous laws and decrees

relating to labor were codified in the official labor code of Chile.

The Chilean labor movement had its beginning in the latter part of the 19th century, but not until 1925 did it gain real strength and importance with the passage of a law authorizing the establishment of labor unions. The largest federation of labor unions, the Confederation of Chilean Workers (*Confederación de Trabajadores de Chile*), was formed in 1936. Its membership is varied and includes miners, teachers, artisans, and factory workers. A total of over 1,800 labor unions were organized between 1925 and 1950.

The principle behind Chilean social security legislation is that such assistance is not charity but a right of citizenship and essential to national progress. The Workers' Compulsory Social Security Fund, established in 1925, includes such benefits as medical attention for the insured and their wives (before and after childbirth), milk for babies, medical care for children up to two years old, old-age and disability benefits, funeral expenses, and dental care. The fund also gives special attention to preventive medicine, especially to tuberculosis, venereal, cardiovascular, and infectious diseases. In addition some 40 other institutions offer benefits to workers.

The government has long been interested in low-cost housing. It established the Council for Workers' Housing in 1906, and in 1949 a new housing agency, the People's Housing Fund, constructed 4,650 dwellings, as compared with 2,000 in 1948. However, all these efforts have only scratched the surface, and the standard of living is still incredibly low and the accident rate high.

Rural labor lags far behind in comparison with the benefits obtained by urban workers. Farmers enjoy no pensions or health insurance. Farm laborers (*inquilinos*) are allowed by the proprietors of large estates to take up as much land as they can till with the aid of their families. They pay no rent, and the produce of the land is their own. However, each laborer must sell his services to the landlord whenever the need arises and at less than prevailing wages. Thus a permanent supply of labor is assured the landlord, but the farm laborer is obliged to work for the landlord at precisely the time his own little plots need attention. This results in apathetic, inefficient service on both big estates and small plots.

Education.—Suitable educational facilities for the middle and upper classes in the cities were developed in the latter half of the 19th century, but it was not until after World War I that the task of educating the rural and urban working classes was taken in hand. In 1920 elementary education was made compulsory for at least six years in the cities and four years in the rural sections. In 1928 the compulsory rule was extended to include all children between 7 and 15. The compulsory attendance law was enforced only partially, as many districts were without educational facilities. Moreover, the population continued to increase at a faster rate than the number of schools; from 1940 to 1950 the total population rose 18 per cent while only 1.2 per cent more schools were established. In 1950, out of 1,266,413 children of school age, 535,237 were enrolled in 3,683 public primary schools. The illiteracy rate for the total population, estimated at 50 per cent in 1920, declined to approximately 26.5 per cent in 1940 and has since continued to fall at a steady rate.

Primary education is free and nonsectarian.

During the 1920's the schools were reorganized in accordance with modern methods. The government brought in a group of well-trained German teachers, who were placed in charge of normal and pedagogical school classes. Psychology courses and new teaching methods were introduced. Another reorganization, placing stress on vocational training, was undertaken beginning in 1939. Chile has given special attention to the training of primary teachers. Public and private kindergartens are available for children from four to six. Secondary schools are both public and private; the government *liceos* give six-year courses. There are also numerous special vocational schools.

There are five institutions of higher learning, headed by the University of Chile, which must approve candidates for degrees of the other universities. The others are the University of Concepción, Federico Santa María Technical University at Valparaíso, and the Catholic universities at Santiago and Valparaíso. In addition, the Institute of Bacteriology provides training for public health physicians and bacteriologists, and there are three schools of social service. Educational statistics for 1948, for both public and private schools, showed 745,999 pupils in 5,947 primary schools; 74,721 in 296 secondary schools; 3,819 students in 13 normal schools; 65,104 in 203 special schools; and 9,061 in the universities.

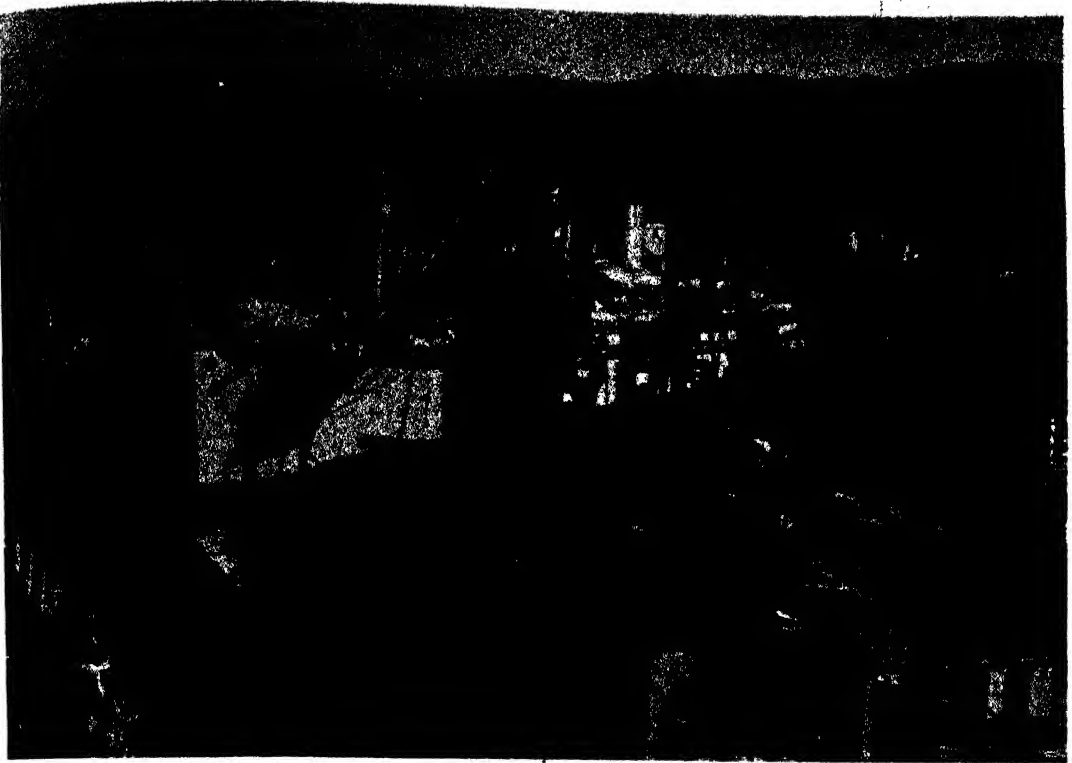
HISTORY

The dominion of the Incas of Peru included the northern and central portions of Chile—probably no farther south than the Maule River. In 1535 the Spanish conquerors of the Inca Empire sent their first expedition southward along the Pacific coast; but the task of adding this territory to the Spanish possessions in Peru and Upper Peru (Bolivia) was not undertaken in earnest until 1541, nor was it brought to a successful conclusion without desperate fighting in the second half of the 16th century. The conqueror Pedro de Valdivia, founder of Santiago in 1541, suffered defeat and death in 1553 at the hands of Lautaro, the young Indian leader—not of the famous Caupolicán as many writers have asserted. The conquest was resumed by García Hurtado de Mendoza in 1557–1561, and Spaniards reached the Strait of Magellan; but the Araucanians offered a stubborn resistance, and even as late as the 19th century they made good their prior claim to a large part of the country below the Bío-Bío.

Having been conquered from Peru, Chile became part of the Peruvian viceroyalty. It was administered by governors, who presided over the *audiencia* established in Santiago in 1609. In 1778, however, when the Spanish colonial system was reorganized by Charles III, Chile became a captaincy general, and received virtual autonomy of Peru.

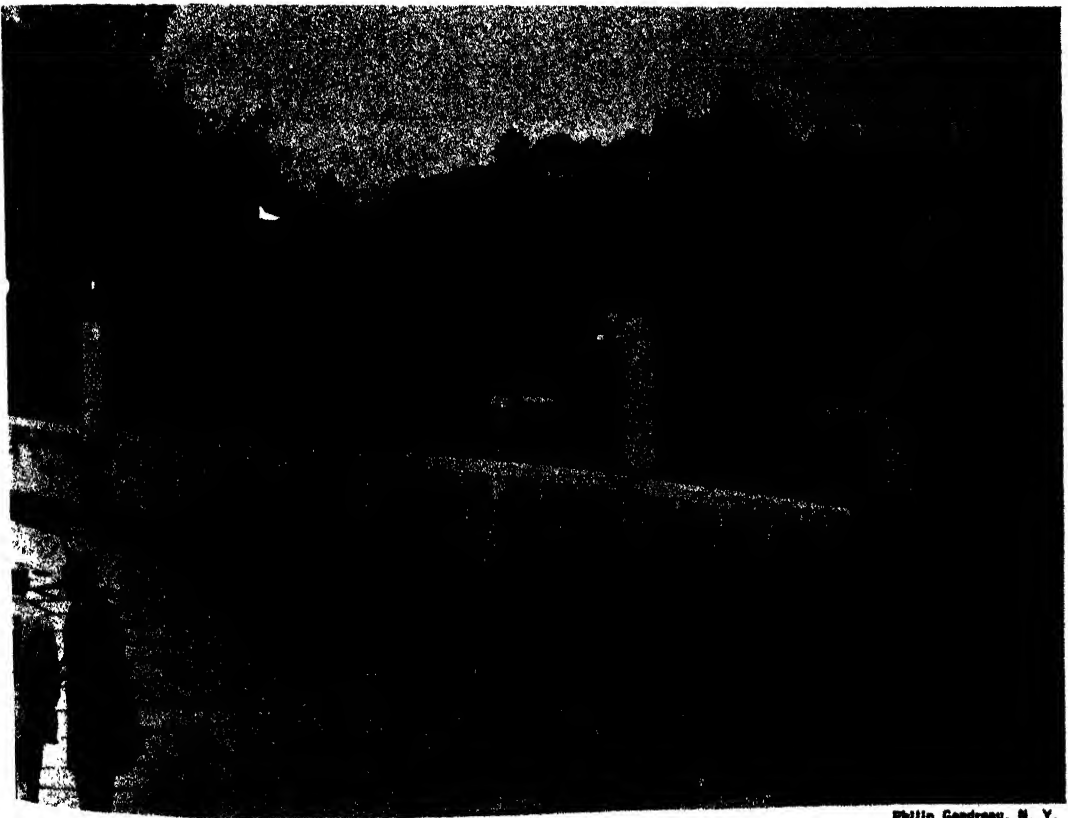
Independence.—The first national government was proclaimed on Sept. 18, 1810, to rule the country in the form of a junta during the captivity of the king of Spain, whom the French held prisoner. The first national congress of Chile met on July 4, 1811. Among the leaders present was Bernardo O'Higgins, son of an Irish-born former viceroy of Peru. O'Higgins had been educated in England, and while there became acquainted with Francisco Miranda and other forerunners of Latin American independence. He carried home his dream of sovereignty for Chile, a dream he never relinquished despite setbacks.

CHILE



Harbor Scene, Valparaíso.

Philip Gendreau, N.Y.



Casino Gardens, Viña del Mar, near Santiago.

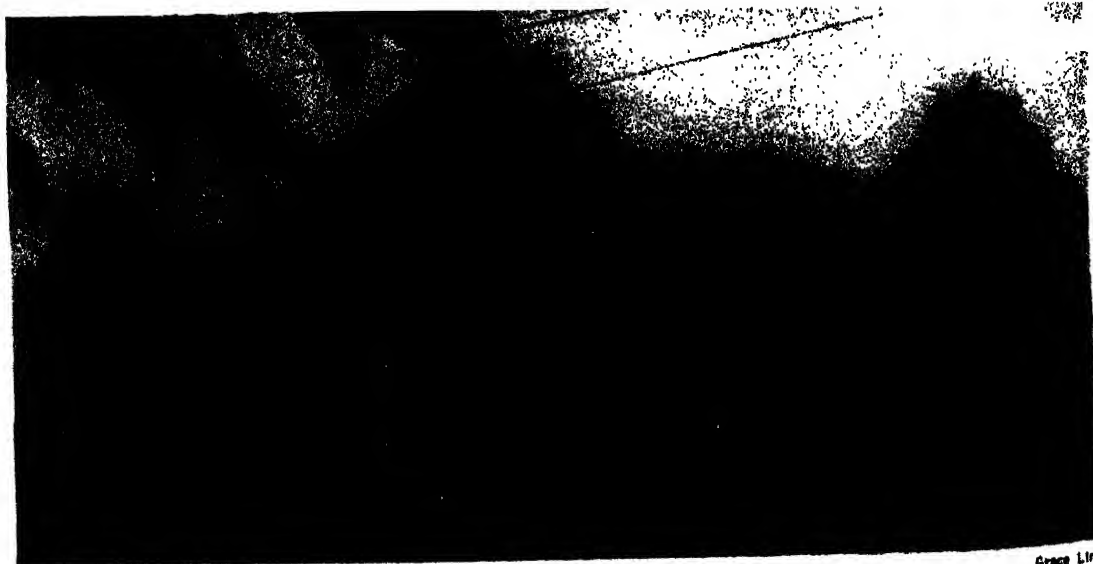
Philip Gendreau, N. Y.

CHILE



Chilean fishermen beaching their boat, Quintay.

Unation



Palace of Fine Arts, Santiago.

Grace Line

The first ruler of independent Chile was José Miguel Carrera, who ruled the country as dictator from 1811 to 1813, when he was replaced by O'Higgins. Assisted by the rivalry between the two leaders, royalist armies from Peru reconquered the country after a bitter struggle. Following O'Higgins' defeat at Rancagua near Santiago on Oct. 1-2, 1814, the patriot army of some 3,000 men crossed the Andes to Mendoza.

Final victory was won in 1817-1818 with the help of Argentine troops under Gen. José de San Martín. Following the victory of Chacabuco (Feb. 12, 1817), which delivered Santiago to San Martín, the latter was offered the office of supreme director of Chile, but declined it in favor of O'Higgins. The independence of the country was proclaimed on Feb. 12, 1818, and made a reality with the decisive victory of Maipú (April 5, 1818) in defense of Santiago, although Spain did not formally recognize Chile as an independent power until the conclusion of a treaty in 1844.

O'Higgins' first task was to restore law and order. He built a navy, improved cities, promoted trade and agriculture, and opened public schools and libraries. In spite of the prosperity that these reforms brought, opposition by the landed aristocracy to some of O'Higgins' policies caused him to call a constituent assembly in 1822 for the purpose of drafting a constitution to settle the form of government. This constitution did not come into force, however, since continuing unrest forced O'Higgins to resign on Feb. 28, 1823. The various factions could not be reconciled, and, following the supreme directorship (1823-1826) of Ramón Freire, their conflicts resulted in numerous changes of government and constitutions, finally culminating in civil war (1829-1830) between Conservatives and Liberals, in which the former were victorious. The Constitution of 1833 established a semipopular form of centralized republican government which endured until 1925. Diego Portales (1793-1837), who exercised dictatorial control while holding various offices in the cabinet, was the dominant figure of the time.

The period of Conservative supremacy lasted through the administrations of presidents Joaquín Prieto (1831-1841), Manuel Bulnes (1841-1851), and Manuel Montt (1851-1861), and may be said to end with the election in 1861 of José Joaquín Pérez, candidate of the moderate Liberals and Conservatives, but acceptable to the opposition. The principal event in foreign affairs during this period was the war (1836-1839) in which the Chileans overthrew the confederation of Peru and Bolivia under Andrés Santa Cruz. In 1864 hostilities broke out between Peru and Spain, and Chile declared war on the latter in the next year. Valparaíso was bombarded by a Spanish Fleet on March 31, 1866, but there were no engagements of major importance.

Liberal Era.—President Pérez was followed by Federico Errázuriz Zañartu (1871-1876), Aníbal Pinto (1876-1881), under whom began the War of the Pacific, and Domingo Santa María (1881-1886), under whom the war was concluded.

War of the Pacific.—For many years the respective rights of Bolivia and Chile in the nitrate region bordering the Pacific Ocean remained undecided; but in 1874 an agreement was entered into between the two countries, which apparently disposed of the question at issue, fixing the boundary at latitude 24° S. Since the exploitation of these lands by Chileans was increasing, Bolivia

reopened the dispute in 1878 by imposing an export tax on the nitrate obtained in Bolivian territory. A Chilean company at Antofagasta refused to pay the tax, alleging that it violated the treaty of 1874. The Bolivian government's reply was an order for the sale at auction of the property of the offending company. Thereupon the Chilean government sent a man-of-war and soldiers to seize the port of Antofagasta (Feb. 14, 1879). Bolivia declared war on March 1, but it soon became apparent that Chile would have to reckon with Peru also, since that country had signed a secret defensive treaty with Bolivia in 1873. Chile declared war against the allies on April 5, 1879. The presidents of Peru and Bolivia assembled their forces at Tacna, and its neighboring port of Arica, and the defense of Iquique, which was being blockaded by Chilean warships, was entrusted to a sufficient force.

The initial success in the all-important struggle for control of the sea fell to the allies. Two wooden warships blockading Iquique, the corvette *Esmeralda* and the gunboat *Covadonga*, were attacked by two Peruvian ironclads, the frigate *Independencia* and the turret ship *Huáscar*, on May 21, 1879. The *Huáscar* sank the *Esmeralda*, but the *Independencia* ran aground and was destroyed, the *Covadonga* escaping southward. Five months later, on October 8, the *Huáscar* fell in with the two powerful ironclads *Cochrane* and *Blanco Encalada* of the Chilean Navy off Point Angamos near Mejillones. A fight of great severity ensued, ending with the surrender of the Peruvian vessel, which was repaired and added to the Chilean Navy. For all practical purposes, the Peruvian Navy had now ceased to exist, and the resulting ability of the Chileans to move their troops by sea at will proved decisive.

A Chilean army had assembled at Antofagasta, whence part was transported north of Iquique to Pisagua, which was captured on Nov. 2, 1879. The allies, advancing with reinforcements, were defeated in the Battle of San Francisco (or Dolores) November 19, but before the close of the month they won a hard-fought battle against the Chileans at Tarapacá on the 27th. Nevertheless, the allies abandoned the region to the Chileans, and the next Chilean attack was delivered on the Peruvian coast above Arica, a Chilean army landing at Ilo on Feb. 25, 1880. It advanced inland in March, capturing Moquegua and crushing the allied army at Tacna on May 26. This ended Bolivian participation in the war. The port of Arica was attacked by Chilean land and sea forces, and fell on June 7, after resisting desperately.

In order to bring the war to a rapid conclusion, the Peruvian coast was then laid waste by the Chileans. Mollendo was destroyed, Callao and other ports were blockaded, and in November and December 1880 Chilean forces were landed south of Lima at Pisco and near Lurín, whence they advanced on the Peruvian capital. Following two sharp engagements near Lima, the city fell to the Chileans on Jan. 17, 1881, thus in effect ending the war, although the Peruvians kept up a guerrilla resistance for another two years.

As the fruit of her victory, Chile occupied the entire Bolivian seacoast, thus cutting that country off from the Pacific, as well as Peruvian territory north to and including, conditionally, the districts of Arica and Tacna. A truce was concluded between Bolivia and Chile by the Treaty of Valparaíso (1884), although the Bolivians were utterly averse to any permanent arrangement

which did not give them access to the sea. Renewal of negotiations for a definite treaty, which would include the concession of a seaport to Bolivia, was repeatedly urged by that country, but without success. Thus the war was not formally ended until Oct. 20, 1904, when Bolivia recognized Chilean possession of her former seacoast.

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Congressional Revolt.—Under the outstanding liberal president José Manuel Balmaceda (1886-1891), further reforms were introduced and the country enjoyed exceptional prosperity. However, his dictatorial tendencies, particularly his refusal to appoint a cabinet satisfactory to Congress, precipitated a congressional revolt in 1891. The navy and all conservative elements rallied behind Congress in the ensuing civil war. Balmaceda's forces were defeated, and he committed suicide (Sept. 19, 1891). The leader of the congressionalists, Jorge Montt, then became president (1891-1896), and was succeeded by Federico Errázuriz Echaurren (1896-1901), Germán Riesco (1901-1906), Pedro Montt (1906-1910), Ramón Barros Luco (1910-1915), and Juan Luis Sanfuentes (1915-1920).

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system. The presidents of Chile thereafter generally accepted the wishes of the majority group in Congress, but due to the development of numerous parties and the resulting partisan factionalism and political maneuvering, the results were disappointing. There were innumerable cabinet changes and not infrequent political crises when opposing blocs and the president became deadlocked over some major or minor political issue. As a result of this situation, social and economic progress was retarded and disillusionment with the parliamentary system grew. Efforts to improve the economic and social status of the laboring masses were insufficient to prevent the development of a radical, class-conscious labor movement that was strongly influenced by Marxism. This movement for the elimination of class inequalities and the collectivization of production and distribution gained rapid headway during and after World War I.

Meanwhile Chile passed safely through a series of international crises that repeatedly threatened to precipitate war. The first of these disputes was the *Baltimore* affair. The sympathy shown by the United States minister, Patrick Egan, for President Balmaceda's cause during the civil war aroused resentment against the United States among the partisans of Congress. This resentment flared out in a street fight in Valparaíso on Oct. 16, 1891, between a Chilean mob and a band of sailors on shore leave from the United States cruiser *Baltimore*. Two sailors were killed and several wounded. The Chilean government refused to acknowledge responsibility for the affair until an ultimatum from Washington forced it to apologize and to pay an indemnity of \$75,000.

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Beginning in 1929 the Ibáñez regime ran afoul of the world economic depression, which struck Chile with exceptional severity. By 1932 Chilean foreign trade had fallen to one sixth of its 1929 value, while government revenues were less than one third of their former total. It proved impossible to sustain the dictatorship under these conditions. In July 1931 a strike against the regime was begun by university students and it quickly spread to include the laboring and professional classes. Ibáñez fled to Argentina (July 26).

From then until the end of 1932 Chile experienced a bewildering succession of governmental overturns, produced for the most part by military coups. Ex-President Alessandri, candidate of the radical elements, was defeated for the presidency on Oct. 4, 1931, by Juan Esteban Montero, but the latter was overthrown on June 4, 1932, by another coup d'état; and more shortlived provisional governments followed until another election was held on Oct. 30, 1932. This time Alessandri ran as the moderate Socialist candidate against the radical Socialist leader Col. Marmaduke Grove, and was elected. With the support of the landed aristocracy, the bulk of the army, and a private antiradical militia, he served out the full six-year term ending Dec. 24, 1938. Holding diverse and troublesome opposition groups in check by occasional arrests, deportations, and bans of public

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Ross, a member of the aristocracy, became the candidate of a bloc of conservative parties in the presidential election of Oct. 25, 1938, but was defeated in a close vote by Pedro Aguirre Cerda, candidate of the leftist Popular Front. Again, as in 1920, the conservative block challenged the validity of the election, and the nation hung on the verge of civil war until army and police chiefs forced Ross to concede his defeat and leave the country. Aguirre Cerda, a wealthy landowner and lawyer of liberal views, pledged his government to provide the poverty-ridden and demoralized Chilean masses with "food, culture, clothing, and housing." He ousted officials sympathetic to the old regime from all departments of the government, army, navy, and police. Immediate steps were taken to introduce an eight-hour working day for public employees and to lower the prices of staple foodstuffs. A program aiming at increased agricultural and industrial production and reduced living costs was announced. It called for the construction of hydroelectric plants to furnish cheap current for new industries, and of new highways, schools, and workers' homes. Farm laborers were to be settled on unused lands and education reorganized on a more popular and vocational basis.

While legislation to carry this program into effect was before Congress, the most disastrous earthquake in the republic's history wrecked six of the richest agricultural provinces of central Chile on the night of Jan. 24, 1939. About 50,000 people were killed, 700,000 left homeless, and property damage estimated at over \$30,000,000 was inflicted. This serious setback to the government's economic program was followed in September by the outbreak of World War II, which curtailed Chile's export markets and raised the prices of imported articles. In 1940 severe storms in the nitrate region of the north and in the Valparaíso district caused further damage. Meanwhile the government was harassed by sporadic conspiracies and minor revolts by opposition groups, by the growing political activities of German Nazi and Spanish Fascist organizations, and by serious dissensions among the Popular Front parties and leaders. Nevertheless, it pushed ahead with its program of economic reform while carrying out an ambitious plan for the relief and reconstruction of the earthquake-devastated regions. Two fiscal corporations to finance new production and reconstruction, respectively, were established under a law promulgated on April 28, 1939. These were the Corporación de Fomento de la Producción (Corporation for the Development of Production) and the Corporación de Reconstrucción y Auxilio (Reconstruction and Relief Corporation). Funds for both purposes were obtained by higher taxes on the wealthy, bank loans, and private and governmental credits obtained in the United States. President Aguirre had hardly begun his work of reconstructing the country when he died on Nov. 25, 1941.

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Liberals, Democrats, and independents. President Ríos made a strenuous effort to carry out the work begun by his predecessor, and planned the large steel mill at Huachipato, near Concepción, an important mining center. But Ríos did not live to see the fulfillment of his plans either; he died on June 27, 1946, before completing his term of office. During the Ríos administration Chile aligned herself definitely on the side of the democracies in their fight against the totalitarian Axis powers, severing diplomatic relations with the Axis in 1943 and declaring war on Japan in 1945.

The election of Ríos' successor on Sept. 4, 1946, was a lively contest. A coalition of Radicals, Communists, and Democrats presented Gabriel González Videla as their candidate, who defeated Bernardo Ibáñez, candidate of the Socialists, Eduardo Cruz Coke, candidate of the Conservatives and Falangists, and Fernando Alessandri, candidate of the Liberals, Agrarian Party, and various independent groups. The efforts of the González administration were directed toward trying to put the Chilean economy on its feet in the postwar years, stimulating industry, and raising the standard of living. The industrial development program initiated by González included these latter objectives, as well as a better utilization of the country's natural resources, but political turmoil during his administration did not permit the accomplishment of all that was desired. Shortly after he took office, González broke with the Communist Party (declared illegal in 1948), with whose help he had won the election, and some of whose members held posts in his cabinet. Next he governed with the support of the Radicals, then with the independents, then with various opposition parties, and finally with the aid of some nonpolitical friends. All these "experiments" created widespread discontent, contributing little to alleviating the soaring cost of living. Thus on Sept. 4, 1952, Gen. Carlos Ibáñez del Campo was again elected president, to succeed González Videla. He was elected principally with the support of independents, Falangists, the Agrarian-Labor Party (a Fascist group), and some Socialists. Ibáñez defeated Pedro Enrique Alfonso, Radical candidate supported by the administration and the Conservative Christian Socialists, Arturo Matte Larraín, candidate of the Liberals and Traditional Conservatives, and Salvador Allende, a Socialist supported by the Communists. Ibáñez began his administration cautiously, chiefly in order to vindicate himself before the people for the dictatorial policies of his previous administration.

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ANTONIO J. POSADA,
Pan American Union.

CHILE MILL, chil'è (also **CHILI MILL**), a large edge mill for pulverizing ore as a preliminary to securing the values (metal content). In these machines vertical rollers run in a circular enclosure or die. The rollers and dies are usually of steel, although stone was formerly in use.

CHILE NITER or **CHILE SALTPETER** or **CHILEAN NITRATE**. See **NITRATE OF SODA**.

CHILI, chil'i (also **CHILLI** or **CHILE**), the common name for the plant *Capsicum frutescens* (see **CAPSCUM**), or for its fruits which are used to make red, or cayenne pepper, chili sauce, chili vinegar, so-called Tabasco sauce, and a variety of peppery dishes. In the United States the best-known of the latter is chili con carne, a stew of meat, beans, minced chilies, and other spices. Its name, originally Spanish, means "chili with meat."

The many varieties of *C. frutescens* produce peppers which may be round, conical, or elongated in shape, and red, yellow, or purplish in color. Their flavor varies from mild to acrid. The term chili is usually understood as referring to the pungent variety, especially to an elongated red pepper from 3 to 12 inches in length.

CHILIASM, kil'i-áz'm. See **MILLENNIUM**.

CHILKAT INLET, chil'kät, inlet, Alaska. It extends inland for about 15 miles in a northwesterly direction from the head of the fjord called Lynn Canal (about 65 miles north-northwest of Juneau) to the mouth of Chilkat River.

CHILKO LAKE, chil'kō, lake, British Columbia, Canada, located in the Coast Mountains at an elevation of 3,842 feet in the southwestern section of the province. Chilko is long and narrow in shape, with an area of 75 square miles. Its waters exit at the northern end by Chilko River, which flows northeastward into the Chilotin, an affluent of the Fraser.

CHILKOOT INLET, chil'kōöt, inlet, Alaska. It extends inland for about 20 miles to the north and north-northwest from the head of the fjord called Lynn Canal about 65 miles north-northwest of Juneau. Taiya Inlet, on which Skagway is located, is an arm of Chilkoot Inlet, extending from Haines for about 12 miles to the north-northeast. Chilkoot Inlet was the approach to Chilkoot Pass and the Yukon River during the gold rush to the Klondike region starting in the 1890's.

CHILKOOT PASS, a pass over the Coast Mountains between Alaska and British Columbia, Canada. It is about 20 miles north of Skagway. Following the discovery of gold in the Klondike ... 1896, Chilkoot Pass was traversed by thousands of gold seekers on their way to Dawson, the principal starting point for the Klondike region. The trail they followed starts from Dyea, at the head of Taiya Inlet, and crosses the

Pass at an elevation of 3,500 feet, to the head of Lake Lindeman, a total distance of 28½ miles. From the latter place to Dawson City is 548 miles. The Chilkoot Pass route is the old trail used for generations by the Indians, and for many years was the only one taken by miners and prospectors to reach the interior. It is by far the shortest route to the Yukon. The difficulties and dangers attending this route are many, and the steepness and roughness of the ascent have proved fatal in numerous instances, to those unaccustomed to endure hardships. The summit of the Pass is 13 miles from Dyea, the first six miles being traversed by a good wagon road. Owing to the winding of the Dyea River that stream had to be crossed several times by ford or ferry. The trail then enters a narrow cañon with steep, rocky sides, which it follows to Sheep Camp, four and a half miles farther on, which point is the timber line. From Sheep Camp to the summit the rise is from 1,800 feet in three and a half miles, to 1,000 feet in half a mile, and here masses of broken rock make the ascent, which is in some places almost perpendicular, difficult and hazardous. As a general route to the Klondike and to the country over the mountains Chilkoot Pass has been superseded by the railway through White Pass.

CHILLAN, chēl-yān', Chile, capital of the province Nuble, about 56 miles northeast of Concepción. It consists of an ancient and a modern portion, the former built by the Spanish conquerors, who made it a place of some strength, in which the early settlers often found an asylum when hard pressed by the Araucanians. The old town was founded in 1579, and destroyed by an earthquake in 1835. The new town was built shortly after the latter date. It is regularly built and has a Franciscan missionary church and a normal school. To the southeast are sulphur baths, which were discovered in 1795, and to the east is the volcano of Nevado de Chillán, 9,528 feet high. Pop. 34,269.

CHILLED IRON, iron cast in metal molds called chills, where, on account of the rapid conducting of the heat, the iron cools more quickly on the surface than it would do if cast in sand. The effect of this chilling is to leave the interior of the casting soft and tough while the surface is hardened. This property of iron is taken advantage of by iron founders to harden specified parts of castings, those parts of the molds being of iron while the rest is of sand. It is used in making axle-boxes, hubs, plow-shares and some hammers and anvils. The iron selected for making chilled castings should be entirely free from silicon which interferes with the hardening, and it should have a comparatively small content of carbon. Minute percentages of sulphur and manganese, on the other hand, contribute to the desired result.

CHILLIANWALLA, Battle of, an engagement in India between the Sikh forces in considerable strength, and the British commanded by Lord (afterward Viscount) Gough, fought 13 Jan. 1849. The Sikhs were completely routed, but the loss of the British was very severe: 26 officers were killed and 66 wounded, and 731 rank and file killed, and 1,446 wounded. The Sikh loss was 3,000 killed and 4,000 wounded. On 21 February, Lord Gough

attacked the Sikh army, under Shere Singh, in its position at Goojerat, and the whole of the enemy's camp fell into the hands of the British.

CHILLICOTHE, chīl-i-kōth'ē, city, Missouri, and Livingston County seat; altitude 773 feet; on the Wabash; Chicago, Milwaukee, Saint Paul and Pacific; and the Chicago, Burlington and Quincy railroads; 87 miles northeast of Kansas City. It is in an orchard, farming, and livestock area with coal deposits and road gravel pits. The chief manufactures include tile, hardwood lumber, gloves, other farm machinery, and barbers' supplies. The city has a hospital, a state industrial school for girls, and a public library. It was settled about 1830 and incorporated in 1855. Pop. (1950) 8,694.

CHILLICOTHE, city, Ohio, and Ross County seat; altitude 643 feet; situated in the foothills of the Allegheny Mountains overlooking the Scioto River valley, above which rises in the background Mount Logan; and on the Scioto River and Paint Creek, about 40 miles south of Columbus, the state capital, and 96 miles east of Cincinnati. It is served by the Baltimore and Ohio; Norfolk and Western; and Chesapeake and Ohio railroads; also is on a network of modern state and federal highways. It is an industrial city and the business center of a fertile farming and grazing district which produces a wide variety of agricultural products; hog, cattle, and wheat raising and dairying are the leading sources of farm income. The city has railroad shops, printing and publishing, and manufactures of paper and paperboard, shoes, aluminum ware, dairy and other food products, beverages and liquors, millwork, furniture, chemicals, concrete and other products. Its cultural and recreational facilities include a modern public school system, parochial schools, a junior college (branch of Ohio University), a Carnegie public library, the Ross County Historical Society Museum, amusement centers, parks, playgrounds, lakes, and golf courses. Among the landmarks of the city are "Adena," home of Gov. Thomas Worthington, designed by Benjamin H. Latrobe, now a state memorial; and the building, erected in 1798, used by Arthur St. Clair as headquarters while governor of the Northwest Territory. Chillicothe, first incorporated in 1802, has councilmanic government. At Camp Sherman about five miles north of the city the United States government maintains an Industrial Reformatory, a Veterans' Hospital, and Mound City Group National Monument.

History.—The site of what is now Chillicothe was first settled by Nathaniel Massie and others from Kentucky and Virginia in 1796, the settlement being called Chillicothe (Indian for town). In 1800 Congress made Chillicothe the seat of government of the Northwest Territory. With the admission of Ohio to the Union as a state in 1803 it served as the state capital from 1803-1810 and from 1812-1816, when the capital was transferred to Columbus. Its daily newspaper, the Gazette (1800), is the oldest continuously-published newspaper published west of the Alleghenies. Since the beginning of the 19th century, Chillicothe has experienced a slow but solid growth based upon the development of the natural resources of the vicinity; industry, agriculture, and trade have been the

major contributing factors towards its economic progress. During World War I, Camp Sherman, training center for 50,000 recruits, was situated just outside the city. The celebration of Ohio's 100th anniversary as a state was held in Chillicothe in 1903, and in 1912 the fourth Constitutional Convention of the state met here for one session. Pop. (1940) 20,129; (1950) 20,121.

CHILLINGHAM WHITE CATTLE.

See WHITE CATTLE.

CHILLINGWORTH, William, English Anglican divine and controversialist: b. Oxford, October 1602; d. Chichester, Sussex, Jan. 30, 1644. He was matriculated at Trinity College, Oxford, in 1618, and in 1628 was made a fellow of the same college. Having been won to the Roman Catholic Church through the arguments of the Jesuit, John Fisher, Chillingworth entered the English college at Douai (Douay) where William Laud, then bishop of London, by correspondence implanted in his mind doubts regarding the foundation of the Roman Catholic system; and, having resolved to make a thorough investigation, Chillingworth returned to England in 1631 after a few months abroad. The result was that he declared for Protestantism and in 1634 set forth, in a treatise that was not published and is now lost, the grounds of his conclusion. Laud procured his nomination to a church benefice in 1635, but Chillingworth's scruples about subscription to the 39 articles and acceptance of the Athanasian Creed was an obstacle that could not then be overcome. In 1638 was published his great work, *The Religion of Protestants a Safe Way to Salvation*. In the preface he explained away his former scruple about the 39 articles, and that same year was named prebendary and chancellor of Salisbury.

CHILLIWACK, town, British Columbia, Canada, on the Fraser River, 64 miles east of Vancouver on the old Yale road, now a link of the Trans-Canada highway. It has canning, lumber, and furniture plants along with other minor industries. A dairying, livestock, and fruit and tobacco growing area surrounds the town which has 6 churches, public and high schools, a hospital, a weekly newspaper, a library, and four banks. It is served by the British Columbia Electric and the Canadian National railways, an airport, and a ferry to the Canadian Pacific Railway at Agassiz. Pop. (1951 est.) 4,000.

CHILLON, shē-yōn' or shī-lōn', castle, Switzerland, on Lake Geneva, six and one-half miles southeast of Vevey, once an important stronghold of the counts and dukes of Savoy, and the prison house of François de Bonnavard, prior of Saint Victor, Geneva, from 1530 to 1536. It stands on a rock rising 22 yards from the shore of the lake, and is reached by a bridge. It probably dates from the 9th century. Bonnavard was confined in it by Duke Charles of Savoy because he had assisted the republic of Geneva, with which the duke was at enmity. Lord Byron's poem, *The Prisoner of Chillon*, founded on this incident, has made it well known.

CHILOE, chē-lō-ā', province, Chile, consists of the island of that name on the west coast, part of the mainland lying beyond the narrow Strait of Chacao on the north and the Gulf of Corcovado 30 miles wide on the east, and of

a number of neighboring islets, mostly uninhabited; area 9,052 square miles. The island of Chiloé is 115 miles long, 45 miles wide; area 4,700 square miles. Chiloé Island is hilly in the interior, and everywhere covered, except immediately along the shores, with nearly impassable forest. The climate is mild and not unhealthy, although inordinately wet, with an average of only 51 sunny days per year. The Indians belong to a subdivision of the Araucanian family. Timber and coal are at present the chief exports from the island though the exports are very small. In the eastern part the soil is fertile and well cultivated. Corn, wheat, barley, and hemp are produced extensively and domestic animals are plentiful. Oysters, which are very scarce elsewhere in South America, are found in large quantities in the Chiloé Archipelago. The potato here, as in other parts of South America, grows wild. The Spaniards discovered the archipelago as early as 1558. Chiloé was the last part of Spanish America under Spanish rule, which it was not rid of until 1826. The capital and chief seaport, Ancud, on the north coast of the island has a good harbor, is the seat of a bishop and has a population of about 13,981. Pop. of province (1943 est.) 91,355.

CHILON, kī'lōn, son of Damagetus and one of the so-called Seven Wise Men of Greece. He flourished about the beginning of the 6th century B.C., and was a native of Sparta, and one of the ephori, a body of magistrates which he is said to have originally introduced. Chilon claimed that the great virtue of man was prudence or a proper judgment as to coming events.

CHILOPODA, ki-lōp'ō-dā, one of two principal divisions of Myriapoda, represented by the centipede (q.v.). In these animals the body is composed of from a few to between 100 and 200 segments; the body is flattened, and there is but a single pair of legs to each segment. There are three pairs of mouth appendages; that is, a pair of jaws succeeded by two pairs of accessory jaws; while the first pair of legs are modified to form the poison fangs, which contain at their base a poison sac, the ducts from which open by a minute pore, out of which the blood oozes when the creature bites. The Chilopoda are divided into four families—Lithobiidae, Scolopendridae, Geophilidae and Scutigerae.

CHILPERIC, chīl'pēr-īk, two Merovingian kings: (1) **CHILPERIC I**, king of Neustria from 561 to 584. He never was acknowledged king of all the Frankish land, but divided the kingdom with his three half-brothers; he had, however, great power throughout their dominions by reason of his influence with the nobles. The murder of his wife, Galswintha, involved him in a war with her brother-in-law, Siegbert of Austrasia. (2) **CHILPERIC II**, king of Neustria from 715 to 720. He was several times at war with Charles Martel (q.v.), but was forced to submit to him, and was in 719 made king of the Franks.

CHILTERN HILLS, a range of flint and chalk hills in England, extending through Oxford, Bedford, and Buckingham shires; loftiest summit, about 850 feet. These hills were anciently covered with forests, and were infested by numerous bands of robbers. The steward of the Chiltern Hundreds is an officer of the

crown, appointed to protect the people of Buckinghamshire from the robbers of the Chiltern Hills. This office is now a sinecure, but as a member of Parliament can only resign his seat by accepting office, he accepts this sinecure, which he immediately vacates for the benefit of others.

CHILTERN HUNDREDS. See **CHILTERN HILLS**.

CHILTON, Eleanor Carroll, American writer: b. Charleston, W. Va., Sept. 11, 1898. She was the daughter of William Edwin Chilton (1858–1939), a United States senator. After graduating at Smith College in 1922 she went to England to study medieval literature in Oxford and London, and following her return to the United States she published a novel, *Shadows Waiting* (1926). Shortly thereafter she went back to England, where she continued to write stories, plays, and novels. In collaboration with Willis Fisher and Herbert Agar she published a volume of poems entitled *Fire and Sleet and Candlelight* (1928), and with Herbert Agar, *The Garment of Praise* (1929), a collection of essays; and she also published another novel, *The Burning Fountain* (1929). She was married to Herbert Agar in 1933, and the following year they returned to the United States, going to Louisville, Ky., where he was editor of the *Courier-Journal*. Her next novel was *Follow the Furies* (1935).

CHILTON, city, Wisconsin, seat of Calumet County, located on the Manitowoc River 18 miles east of Oshkosh and 8 miles east of Lake Winnebago; it is served by the Chicago, Milwaukee, St. Paul and Pacific Railroad. The city is the center for an agricultural region producing milk, barley, peas, wheat, cattle, corn, cheese, and butter. There are malt and milk condensing plants, a canning factory, aluminum and fertilizer plants, and bottling works. Chilton was founded by a Negro, Moses Stanton, and his Indian wife, a descendant of King Philip. It is governed by a mayor and board of aldermen. Pop. (1950) 2,367.

CHILWA, chil'wā, a lake in Nyasaland Protectorate, on the border of Mozambique and south-east of Lake Nyasa. The length is about 40 miles, but the lake's area varies with the rainfall. David Livingstone discovered the lake in 1859.

CHIMAERA, ki-mēr'ā, in ichthyology, one of a family of oceanic, elasmobranch fishes, Chimaerodae, of primitive structures, a few species of which survive from Cretaceous and Lower Eocene time; noted for their extraordinary appearance. They are small, no living species exceeding three feet. Chimaera have a shark-like body, and heads furnished with strange fleshy projections, especially in the male, where they serve as "claspers"; or the snout may be extended into a sharp beak. The tail is continued into a sort of whip, often nearly as long as the body. One species is frequently caught in the North Atlantic, and others exist in the North Pacific and in the South Seas. Most of them inhabit deep water, where the young are born from eggs laid in leathery cases, like those of rays, on deep bottoms. See also **CHIMERA**.

CHIMAEROIDEI, ki-mē-roi'dē-i, in zoology, one of the primary divisions of fishes, the

equivalent of Holocephali (q.v.).

CHIMANGO, chē-māng'gō, a carrion hawk of South America (*Ibycter chimango*), closely related to the Caracara (q.v.). The plumage is black, with whitish streaks on neck and breast in the adult, which are lacking in the young. Chimangos are particularly numerous in the Falkland Islands. Charles Darwin describes them as without fear of man, frequenting inhabited regions and feeding on all kinds of refuse.

CHIMAY, Princesse de. See **TALLIEN**, JEANNE MARIE IGNACE THÉRÈSE.

CHIMAY, shē-mā', town, Belgium, in Hainaut Province 30 miles southwest of Dinant. Only one of the seven towers of the ancient castle is still extant. Jean Froissart, the French chronicler, was buried at Chimay about 1400. Faience is manufactured, and marble is quarried in the vicinity of the town. Chimay was founded in the 7th century. Pop. (1941) 3,368.

CHIMBAI, chīm-bi', town, Soviet Union, in the Uzbek Soviet Socialist Republic, is located in the delta of the Amu Darya, south of Lake Aral. It was formerly the capital of the Kara-Kalpak Republic. Pop. (1926) 5,720.

CHIMBORAZO, chīm-bō-rā'zō, a peak of the Andes in west central Ecuador, in Quito Province. It has a height of 20,702 feet, and is the highest point in the Cordillera Real. The top is covered with perpetual snow. The mountain has no crater, though it is built of volcanic rock. This mountain was ascended in 1802 by Baron Alexander von Humboldt and Aimé Jacques Alexandre Bonpland who, though they failed to reach the summit, yet mounted to the great height of 19,390 feet, a greater elevation than ever was before attained by man. Their further ascent was prevented by a chasm 500 feet wide. In 1880 the summit was reached for the first time by Edward Whymper, who made two ascents of the mountain.

CHIMERA or **CHIMAERA**, ki-mēr'ā, in Greek mythology, a fire-breathing female monster reported to be of divine origin, brought up by Amisodarus, king of Caria. According to the description of her given in the Homeric poems, the fore part of her body was like that of a lion, the middle like that of a goat and the hind that of a dragon. She laid waste the fields of Lycia and all the country round. Hesiod says she had three heads, one for each of the three animal parts composing her body. She was destroyed by Bellerophon with the help of Pegasus. This mythical monster is supposed to have had its origin in the volcano of the same name, near Phaselis, in Lycia, round the top of which, according to popular belief, dwelt lions, round the middle goats, and at the foot poisonous serpents. The word Chimera early came to be used for a wild dream, owing to the strange, unnatural form of the being described by the poets.

CHIMES. A set of bells from 3 to 12 in number, generally of considerable weight, tuned to the notes of the diatonic scale with sometimes one or two additional half tones. In England these are most often hung "free," that is, so as to swing, and then are called also a "ring"

or "peal." A set of bells tuned to the chromatic scale, with a compass of three or more octaves and hung "fixed" or "dead," i.e., so as not to swing, is called a carillon. Tunes are played automatically on chimes where the bells are hung fixed and on carillons by a revolving drum and hammer mechanism like that of a music box. A chime hung fixed is also played by a chimer, who with his hands operates the levers of a chiming-stand, one lever for each bell. A carillon is also played by a carillonneur who uses both hands and feet on keyboards similar to those of an organ, connected with the clappers. In England a method of playing upon bells hung free, called "change-ringing," has long been in vogue. In this method each bell is separately swung by means of a rope by an individual ringer. The bells are thus made to sound one after another in mathematically defined changing sequences until they come back to the order in which they started. This in complicated changes often involves several hours of ringing. Great expertness is shown by companies of men in this art but the product of their skill is a regularly developed mosaic of sounds rather than music. On chimes only a few simple tunes can be accurately played. On a carillon, however, the chromatic characteristic combined as it is with the extended compass and range in the size of the bells—from several tons to a few pounds—enables the master of its keyboard to play not only the notes of a great variety of music but to interpret sentiment, and produce effects beyond the power of any other musical instrument. While England, because of its many bells, has been poetically called "the ringing isle," bell music has been still more a characteristic of Belgium and Holland and French Flanders through centuries. There carillons, and the great church and town hall towers which contain them, are maintained entirely at the public expense, and the bell music of folk songs, patriotic airs and national hymns, heard day and night and on market and feast days, is a considerable feature in the life of the people. Summer evening concerts in the Low Countries when the city carillonneur plays on the carillon clavier always have brought hundreds together to listen. Such concerts by Josef Denyn, the unrivalled master of the art, on the finest carillon in the world at Mechlin, Belgium, 45 bells, attracted thousands before the Great War. Antwerp's carillon then numbered 47 bells, Ghent's 52, Bruges' 47, Courtrai's 49, Mons' 47. In all there were recently about 70 carillons in Belgium and northern France. In Holland there are also about 70; among the finest are Middleburg, 41 bells; Delft, 40; Amsterdam (Palace), 37; Utrecht, 42; Arnhem, 47; The Hague, 37 and Appingedam, 25. Carillon destruction by Germany has undoubtedly been great. The bells of Ypres, 44; of Termonde, 40 and of Saint Peter's at Louvain, and of Arras are destroyed, and probably many or possibly all others in the occupied regions. The oldest chimes in the United States are those of Christ Church, Philadelphia; Christ Church, Boston; and Trinity Church, New York. California University, Berkeley, has 12 fine bells. Among English Carillons are Cattistock, 35 and Eaton Hall, 28 bells. In Ireland, Queenstown Cathedral has a carillon of 42 bells—the finest bells

in the United Kingdom. Where chimes and carillons originated is not known. Tradition takes us back to the 12th century and the abbey of Egmond in Holland. But it is not until early in the 16th century that authentic records, principally in certain Low Country towns, appear. Louvain had 8 bells in 1525; Hoorn, 10, in 1528; Oudenburg 10, in 1539; Alkmaar 11, in 1541; Ghent 16, in 1543. Thereafter the development of this musical instrument was rapid. D. G. Rossetti, Thackeray, Stevenson, George Macdonald, Thomas Hardy, Victor Hugo, Georges Rodenbach, DeAmicis and others have written of carillon music. Longfellow's 'Belfry of Bruges' is especially well known. Consult Rice, William Gorham, 'Carillon Music and Singing Towers of the Old World and the New' (1925); Coleman, S. N., 'Bells' (1928); Robinson, F. E., 'Among the Bells' (London 1909); Starmer, W. W., 'Royal Academy of Music Lectures' (London 1916); Price, F. P., 'Carillon' (New York 1933); Morris, E., 'History and Art of Change Ringing' (London 1937).

WILLIAM GORHAM RICE.

CHIMES OF NORMANDY, The (Les Cloches de Corneville), opera comique in three acts by Robert Planquette, libretto by Clairville and Gabet, first produced at Paris, 19 April 1877. While called an opera comique, 'The Chimes of Normandy' is rather in the operetta class, the most typical of which are Offenbach's famous series of *operas bouffés*. The story is simple and romantic, if not vital. The music is unaffected and spontaneous and its first success, which was conspicuous even for those days and for audiences which saw many a popular hit, has been repeated wherever the opera has been given. The legend of the chimes is the best known number, but there is scarcely a dull moment in the entire work and half a dozen of the songs are household favorites the world over. The lilting barcarolle, "On billow rocking," the cider song, the waltz song in the last act "That night I'll ne'er forget" and the spritely finales of the first and second act come readily to mind.

LEWIS M. ISAACS.

CHIMNEY (Fr. *cheminée*, related to Latin *caminus*, oven), an upright structure of stone, brick, etc., enclosing one or more flues or passages through which smoke and gas from the fire in a stove, furnace or fireplace may escape into the open air. Originally the term chimney included both the fireplace and the shaft. How far the Greek and Roman architects were acquainted with the construction of chimneys such as we have is a matter of dispute. That kitchens and baths were provided with chimneys appears certain, but how far other apartments were so provided is doubtful. An ancient mosaic found in Algeria, and representing a Roman country mansion, shows chimney stacks projecting above the roof. Of course in southern Europe fires are less necessary than in northern Europe. Chimneys require much attention to make them secure and prevent their smoking, so great an annoyance to domestic comfort. It seems at present to be acknowledged that it is much better to exclude the cold, damp air from the flues, by narrowing the aperture at the top, than to give larger

vent to the smoke at the risk of admitting a quantity of air to rush down the flue. For this reason chimney pots are of great use. The longer a chimney the more perfect is its draft, because the tendency of the smoke to draw upwards is in proportion to the difference of weight between the column of air included in a chimney, and an equal column of external air; and the heated air in the chimney being lighter than the external air, the longer the chimney is the greater is this difference. Short chimneys are liable to smoke, and fireplaces in upper stories are therefore more apt to smoke than those in the lower ones. Two flues in the same chimney should not communicate with each other short of the top. In manufactories tall chimneys are built for the purpose of carrying away the great quantities of smoke, which would otherwise be highly deleterious to the health of those living in the neighborhood. In chemical works, especially, these chimneys are sometimes built to an immense height. Such chimneys are constructed from the inside, by which the expense of the scaffolding is saved. The shafts of most early chimneys were round and the chimneys contained but one shaft each, from the side of which the smoke generally issued, the top being crowned. In France and Italy chimneys came to form a decorative part of the national architecture.

CHIMNEY SWALLOW, *chīm'nī swōl'ō*, the common swallow of Europe (*Hirundo rustica*), so called in Great Britain, where it makes its nests about buildings and in niches in the outside of old chimneys. They are migratory. (See SWALLOWS.)

In the United States the name is given erroneously to the chimney swift, which is similar to the swallow in general appearance and feeding habits, but different from it in structure. The chimney swallow cements its nest together with saliva and attaches it to the rough inside wall of the chimney, from five to ten feet from the top. Since the nests are shallow and not very secure, they sometimes become detached and fall down the chimney. See also SWIFTS.

CHIMPANZEE, *chīm-pān-zē'*, one of the four anthropoid or manlike apes (the others being the gorilla, orangutan, and gibbon). Native to the equatorial forests of Africa north of the Congo, from about 800 miles north to 500 miles south of the equator, and from the Atlantic to somewhat east of the Nile, chimpanzees are usually found in groups of six to a dozen individuals. They are equally at home in trees and on the ground, being more arboreal than the gorilla, much less so than the gibbon. At night they sleep in tree nests, each animal (except infants) constructing a new nest every evening. Their diet is mainly herbivorous, but it seems probable that they occasionally eat bird eggs and insects. Although very strong, agile, and capable of inflicting heavy damage with their teeth, chimpanzees are rather timid and try to avoid combat with man and other animals. They are noisy creatures, vocalizing loudly, stamping, and drumming on the trunks of trees. Such exhibitionistic and bluffing behavior probably often substitutes for actual fighting.

The average weight of the adult chimpanzee is about 115 pounds, with a range of from around 90 to 180 pounds. Males are usually somewhat larger than females. The animal stands approxi-

mately 4½ feet high and has a maximum arm spread of 6 feet. By comparison with man, the arms are long, the legs are short and slightly bent at the knees. The chimpanzee can stand and walk upright, but more usually it moves on all fours, the body weight then being supported on the soles of the feet and on the back of the second joints of the fingers. The bony ridges above the eyes are very prominent, the nose and thumbs are small, the ears are large. The teeth, especially the canines, are relatively large but are of the same kind and number as in man. Most of the body is covered with black hair which may become gray or brownish with age. The skin of the ventral trunk is very light in color; exposed areas, notably the face, hands, and feet become almost black with increasing age and exposure to sunlight.

The newborn chimpanzee weighs about 4 pounds and, except for the ability to cling tightly to its mother, is about as helpless as a human infant. For the first 8 months or longer, mother's milk is its only food, and it may continue to suck at the breast until the end of the second year. Adult stature is attained at about the age of 12 years. Puberty occurs at approximately 9 years. The female has a sexual cycle, averaging 35 days in length, which is characterized by a prominent swelling of the light colored external genital area. Mating usually occurs only during the 10 days or so of maximal tumescence, which occurs midway between successive menstruations. The period of pregnancy is about 8 calendar months. Single births are the rule; twins occur infrequently. The life-span is estimated to be 50 years, but this probably is often shortened by disease or accident.

Because of their physical similarities to man, the apes (Pongidae) are generally assumed to be closely related to man in evolutionary development. Behavioral resemblances to man are especially conspicuous in chimpanzee; this ape is also available in larger numbers and is more adaptable to captivity than the other anthropoids. Chimpanzees are therefore used extensively in biological research, particularly in the study of behavior and its neurological foundations. The brain of chimpanzee resembles that of man in its proportions and patterns of fissurization, but is less than half as large. Sensory capacities are closely similar to those of man. In general, the behavior of chimpanzees is determined more by learning and individual experience, and less by inborn organization (instincts), than is that of lower mammals. Their memory is good, and they exceed most other animals in problem-solving abilities. As compared to man, their intellectual limitations are related to a deficiency in symbolic representation. They communicate by sounds, postures, and gestures, but do not have a language in the usual sense. This lack presumably is responsible also for the almost complete absence of social inheritance, or culture. Resemblances to man are even more pronounced in the wide range of emotional expression, and in sensitivity to their social environment, than in respect to intelligence.

The foregoing account probably applies to most of the varieties or races of chimpanzee which, by some authorities, are classified as separate species on the basis of superficial differences of pigmentation, hair patterning, and so on. There is a little known and rare pygmy chimpanzee, *Pan paniscus*, which may constitute a

separate species; it lives south of the Congo, and is about half as big as some of the other better known types.

HENRY W. NISSEN,
Associate Director, Yerkes Laboratories of Primate Biology.

CHIMU, ché'mōō, the name given to two periods of the pre-Incan civilization of Peru. The first, known as Mochica or Early Chimu, flourished from about 500 to 800 A.D. The pottery from this period, particularly the portrait jars modeled in the form of human heads, is remarkable, and there also survive fine examples of metalwork in copper and gold alloys. By means of irrigation and the terracing of hillsides sufficient food was raised to support a highly developed urban civilization.

This culture was absorbed by the Tiahuanaco after 1000 A.D., but a new Chimu culture, known as Late Chimu, subsequently emerged in the north. It in turn was absorbed by the Incas in the 15th century. See also *ARCHAEOLOGY—New World*; *PERUVIAN ARCHAEOLOGY*.

CHIN. See **KUKI-CHINS**.

CHIN, jīn (KIN), the name of a Jurchen dynasty which ruled northern China from 1115 to 1234 A.D. It rose to power by conquering the Khitan state of Liao, exacted tribute from the Sung emperors, and was finally overthrown by the Mongols. Through their contacts with Sung China the Jurchen gradually adopted Chinese civilization.

CHIN, jīn, or **TSIN**, the name of several Chinese dynasties: Western Chin (265–317 A.D.) and Eastern Chin (317–420 A.D.), of the Six Dynasties period; and Later Chin (936–946 A.D.), of the Five Dynasties period.

CH'IN, chīn, or **TS'IN**, the dynasty which ruled China from 221 to 207 B.C. It succeeded the Chou and was followed by the Han. During this period the greater part of the country was unified, feudalism was abolished, the government was reorganized, and great public works were undertaken. See also **CHINA—The Land, the People, and Their History**.

The name Ch'in is also applied to three minor foreign dynasties which ruled over limited parts of China during the Six Dynasties period: Early Ch'in (351–394 A.D.), a Mongol dynasty in Shensi; and part of Central Asia; Later Ch'in (384–417 A.D.), a Mongol or Tibetan dynasty in Shensi; and Western Ch'in (385–390; 409–431 A.D.), a Turkic or Mongol dynasty in Kansu.

CHIN FLY, a horse botfly (*Gastrophilus nasalis*) which has been confused with the horse bot (*Gastrophilus equi*). This species is smaller than the bot, very hairy, and has a rust-colored thorax. The abdomen is whitish at the base, and the wings are not spotted. It deposits its white eggs on the hairs about the lips or in the nostrils of equine animals, and it is probable that the maggots hatch out more promptly than in other species.

CHIN HILLS, mountain range and district of northwestern Burma. The mountains are from about 5,000 to 8,000 feet high and run generally in a north and south direction, inter-

persed by narrow valleys. They are occupied by part of the Chin tribes (see **KUKI-CHINS**). The district to which they lend their name has an area of 10,377 square miles.

CHINA, chī'ná, a republic since 1912, anciently known to the Western World as CATHAY, is the largest political subdivision of Asia, comprising the major part of the southeastern area of that continent. The natural features of China, its economy, social and political life, history, and culture are treated under the following headings:

- | | |
|---|-------------|
| 1. The Land, the People,
and Their History | 4. Drama |
| 2. Language | 5. Music |
| 3. Literature | 6. Art |
| | 7. Ceramics |

1. THE LAND, THE PEOPLE, AND THEIR HISTORY. China stretches from the center to the eastern extremities of Asia, extending from latitude 53°35'N. to 15°48'N. (Paracel Islands), and from longitude 73°31'E. to 135°2'30"E. It is bounded on the north by Siberia and the Mongolian People's Republic; on the west by Russian Turkestan, Russian Pamir, Afghanistan, and India; on the south by India, Nepal, Bhutan, Burma, Laos, Viet Nam, and the South China Sea; and on the east by Siberia, Korea, the Yellow Sea, and the East China Sea. Its greatest length is about 3,000 miles from west to east; its greatest breadth, about 2,000 miles. The total area is 3,759,115 square miles, usually divided into the 18 provinces of China Proper, Manchuria, Inner Mongolia, Sinkiang, Tibet, and Formosa. In 1949, the officials of the new People's Republic of China announced a plan for dividing China's huge territory into six administrative regions.

In addition to the 18 provinces south of the Great Wall, known to geographers of the 18th and 19th centuries, there are the provinces of Sikang, Chinghai, and Ningsia on the west, and Suiyuan, Chahar, and Jehol on the north, all of which were created in 1928 or 1929, and the 9 provinces of Manchuria, besides the province of Sinkiang (created in 1884), the special territory of Tibet, and the island of Formosa, which became a province in 1945.

The region of China Proper lies in the southeastern part of the republic and occupies 1,373,370 square miles, approximately 36.5 per cent of the whole area. In general, the northern boundary corresponds with the 1,250-mile Great Wall, stretching across mountain and valley to cut off Mongolia. To the west lie the provinces of Chinghai and Sikang and the Union of Burma; to the south, Laos and Viet Nam. Though the 18 provinces occupy little more than one third of the whole territory, they have 86 per cent of the population.

Manchuria, known under Japanese occupation as Manchukuo, consists (since 1945) of the nine provinces of Liaoning, Antung, Liaopoh, Kirin, Sungkiang, Hokiang, Heilungkiang, Nunkiang, and Hsingan, which lie, roughly, between the Khingan Shan and the Siberian maritime province and extend from Jehol and Korea on the south to the Amur River on the north. In Manchuria's 413,306 square miles live 38,584,268 people (1947 estimate), nearly one third of whom are in Liaoning.

Mongolia, a high plateau around the Gobi Desert, is divided politically into the Mongolian People's Republic (Outer Mongolia), which is influenced politically by the USSR; the Tuvian Autonomous Region of the Soviet Union; and the

Chinese provinces of Chahar, Ningsia, and Suiyuan, which are known as Inner Mongolia. The republic, governing a territory of 625,946 square miles and an estimated population of 880,000, was set up in 1924; China maintained nominal sovereignty until the Sino-Russian treaty of Aug. 14, 1945, by the terms of which it became independent.

Sinkiang, now considered a province, is an immense territory of 660,976 square miles with a population of 4,012,330 (1947 estimate). A land of high mountains and deserts, most of the inhabitants live in the Ili River valley or in the oases watered by the Tarim River. Tihwa

line of China, forming a large, somewhat irregular curve, extends in the north from the mouth of the Yalu River in Antung to Tunghing in Kwangtung, a distance of 5,362 miles. The southern half of the coastline is not deeply cut by indentations, but there are numerous good harbors. In the north two peninsulas, Shantung and Liaotung, project to cut off the Gulf of Pohai. Except for the two peninsulas, the shore is low and the soil is alluvial in nature as far south as the Bay of Hangchow. From there to Canton the shore is, in general, rocky and of granite formations, but southwest of Canton it again becomes lower. Numerous islands of all sizes lie along

Table 1—AREA AND POPULATION OF CHINA (1947)

Provinces	Area (in square miles)	Population ¹	Density (per square mile)
Anhwei ..	54,319	21,705,256	399.6
Chekiang ..	39,632	19,942,112	503.2
Fukien ..	45,551	11,100,680	243.7
Honan ..	63,761	28,463,025	446.4
Hopeh ..	54,496	31,810,533	583.7
Hunan ..	79,062	26,171,117	331.0
Hupeh ..	71,955	21,784,415	302.8
Kansu ..	151,160	6,897,781	45.6
Kiangsi ..	66,801	12,725,187	190.5
Kiangsu ..	42,464	40,943,178	964.2
Kwangsi ..	84,527	14,603,247	172.8
Kwangtung ..	84,465	29,101,941	344.5
Kweichow ..	65,714	10,518,765	160.1
Shansi ..	60,394	15,025,259	248.8
Shantung ..	56,944	39,434,799	692.5
Shensi ..	72,552	10,015,672	138.0
Szechwan ..	117,227	48,107,449	410.4
Yunnan ..	162,346	9,171,449	56.5
Total, 18 provinces	1,373,370	397,522,237	289.5
Formosa ..	13,780	6,126,006	444.6
Tibet ..	469,413	1,000,000 ²	2.1
Sinkiang ..	660,976	4,012,330	6.1
Sikang ..	174,332	1,651,132	9.5
Chinghai ..	257,655	1,346,320	5.2
Ningsia ..	90,085	773,325	8.6
Suiyuan ..	127,180	2,166,513	17.0
Chahar ..	109,527	2,114,288	19.3
Jehol ..	69,491	6,109,866	87.9
Manchuria:			
Liaoning ..	26,057	12,111,697	464.8
Antung ..	24,487	3,163,911	129.2
Liaopeh ..	47,612	3,798,056	79.8
Kirin ..	33,701	6,981,277	207.2
Sungkiang ..	31,551	5,295,092	167.8
Hokiang ..	47,730	1,936,000	40.6
Heilungkiang ..	76,562	2,563,234	33.5
Nunkiang ..	25,856	2,407,438	93.1
Hsingan ..	99,750	327,563	3.3
Total, outside China Proper	2,385,745	63,884,048	26.8
Total, China	3,759,115	461,406,285	122.7

¹ Official estimate, mid-1947.

² Estimate by Chinese government.

(Urumchi) is the capital; other important cities are Hami (Qomul), Shufu (Kashgar), and Soche (Yarkand). By reason of its border location contiguous to the Soviet Union, Sinkiang is developing increasing importance.

Tibet (q.v.), a high plateau, surrounded by a rim of towering mountains, has an approximate area of 469,413 square miles. The capital and chief town is Lhasa. Tibet is the source of several important rivers, including the Brahmaputra, Salween, and Indus. Up to the spring of 1950, political control by the People's Republic of China had not been established.

Table 1 gives the names of all the provinces and political divisions, their area in square miles, population, and density of population to the square mile. Population figures are for 1947. The 18 provinces of China Proper are grouped separately.

Physical Features and Climate.—The coast-

the two northern peninsulas and the southern shore, the two most important being Formosa (Taiwan), off Fukien Province, and Hainan, opposite a small peninsula of Kwangtung Province. The coast is washed by three inner seas: the Yellow, the East China, and the South China, cut off from the Western Pacific by Japan, the Ryukyu (Nansei; Loochoo) Islands, and the Philippines. Important ports are Antung, Talien (Dairen), Chinwangtao, Taku, Chefoo, Weihaiwei, Tsingtao, Shanghai, Hangchow, Ninghsien (Ningpo), Minhow (Foochow), Amoy, Swatow, Hong Kong, Canton, and Pakhoi.

In China the general slope of land is from the high mountains of Sinkiang, Tibet, and Mongolia in the west to the low coastal areas in the east. Mongolia is a high plateau, almost 5,000 feet above sea level, surrounded by great ranges of mountains. The Gobi Desert, the greater part of which is in the Mongolian Peo-

ple's Republic, lies in the center of the plateau, a steppe or grassland region too dry for anything but grazing except in the extreme south and along a few of the rivers in the north. Large areas of Sinkiang are either deserts or high mountains. The Tien Shan range cuts the province into two parts; north is the Dzungaria (Sungaria) Basin, watered by the Ili and Irtysh river systems. South of the mountains but north of the great Takla Makan desert lies the Tarim Basin, through which the Tarim River, having come down from the high mountain ranges, flows until it is finally lost in the sands after providing water for oases scattered on a line from Hami to Shufu (Kashgar). Most of the population of Sinkiang lives in these oases or in the valley of the Ili. The ancient Silk Roads both ran through Sinkiang, one north of the Tien Shan and the other, south.

Tibet, a high plateau with an average altitude of about 13,000 to 14,000 feet, has some of the highest mountains in the world forming its rim, the Kunlun Shan on the north, the Himalayas on the south, and on the east the almost impassable ranges running from Sikang south into Yunnan. Tibet is the source of the Indus and the Brahmaputra rivers, which make their way to India; and the Salween, which reaches the sea through Burma and Indochina.

Manchuria is flanked from north to south by two ranges of mountains, on the west by the Great Khingan and on the east by the Changpai; between them are broad and fertile valleys, well watered by several rivers, the chief of which are the Amur, the Sungari, the Ussuri, and the Yalu.

China Proper is bordered on the north by an arm of the Nan Shan (Chilien Mountains) which swings northeast in an arc from Tibet to Manchuria. Between this range, known under several different names, and the broken line of mountains, the Chinling Shan and others (running east and west across central China and rising to 12,000 feet in southern Shensi, 5,000 feet in western Honan, and 3,000 feet in southern Anhwei) lies the great basin of the Hwang Ho or Yellow River, a series of plains characterized by a yellowish soil called loess. This soil, which in places has a depth of 300 feet, was deposited by great winds sweeping in from the wastes of Central Asia; the region under intense cultivation grows corn, wheat, cotton, millet, and rice.

In central China is the great Yangtze Valley, an area of low plains and alluvial soil. The climate is milder than in the valley of the Hwang Ho, and there appear plants of a southern type such as the bamboo and the orange. A large population cultivates rice, tea, and cotton. The greater part of China south of the Yangtze is mountainous though there are few well-defined ranges; but one of them, the Nanling, has a few peaks rising above 6,000 feet; it extends east and west to form the northern boundary of Kwangtung. Another is the range marking the Fukien-Kiangsi border, known as the Tayu Shan in the south and the Wuyi Shan in the north. Coastal China south and east of these two ranges has a subtropical climate with characteristic vegetation.

In the southwest, Kweichow and Yunnan are both mountainous. The former, a country of deep valleys and precipitous mountains, has an average elevation of 4,000 feet. Yunnan, though 2,000 feet higher, is more plateau-like. Its mountains are quite as rugged as those of Kweichow;

but in contrast with those in Kweichow and the other provinces, Yunnan's ranges run in a north and south direction.

China has five sacred mountains: Tai Shan in Shantung, Hwa Shan in Shensi, Sung Shan in Honan, Heng Shan in Hopeh, and Heng Shan in Hunan.

Rivers and Lakes.—Three large river systems drain China: the Hwang Ho or Yellow in the north, the Yangtze in Central China, and the Si Kiang, or West River in the south. The Yellow River, which derives its name from the heavy yellow silt it carries, rises in Chinghai and flows by a circuitous route around mountain ranges through northern China to the sea. Along its 2,700-mile course the river receives many tributaries, the most important of which are the Tao, the Fen, the Wei, and the Lo. Below Tungkwan it is navigable for native boats, but steam launches can be used only 25 miles above the mouth. In the last 500 miles of its extent the river is so choked with silt that in many places its bed rises several feet above the surrounding territory, necessitating high dikes. Below Chenghsien (Chengchow) it is a wandering stream that has changed course seven times between the third millennium B.C. and 1938. In 1852-1855 the river left its old channel in northern Kiangsu and emptied into the Gulf of Pohai. In May 1938, in the course of a battle between the Chinese and Japanese in Honan, the dikes gave way and the river again emptied through northern Kiangsu. In 1947, the Chinese government, with the aid of the United States Army, diverted the river to its pre-1938 channel.

The Yangtze Kiang, China's longest river and the most important for navigation, rises in Chinghai and flows east through central China, draining an area of 756,500 square miles. Of its 3,400 miles only the last 1,000 below Ichang are easily navigable, though smaller boats are able to ascend as far as Pingshan near Ipin (Suifu). Between Ichang and Chungking are the famous Yangtze Gorges, which, because of changing water levels and rapids, are extremely difficult of navigation. Important tributaries are the Min, Kialing, Han, Wu, and the streams of the Tungting and Poyang lakes. Near Shanghai the Yangtze empties through a delta some 40 miles wide, built up by the great amount of silt the river carries.

The Si Kiang, with a course of some 1,200 miles, traverses south China. It empties into the South China Sea through several branches, one of which is the Pearl River on which stands Canton. The river is navigable to Tsangwu (Wuchow) for steamers, and native junks reach interior Kwangsi and Kweichow.

Other important Chinese rivers are the Amur with its tributaries, the Sungari and the Ussuri, and the Yalu, all in Manchuria; the Pei, on which the port of Tientsin lies; the Hwai; the Chientang with Hangchow at its mouth; and the Min, which empties at Minhow. Four other rivers, the Indus, the Salween, the Mekong, and the Brahmaputra, have their source in China but flow through Burma, India, and Indochina. The Tarim in Sinkiang is the most important river in the interior.

Although China has many lakes, few are of any considerable size. Tungting Hu in Hunan, a natural reservoir of the Yangtze, during the summer's high water is about 74 miles long but its area is much reduced in winter. Poyang

Hu in Kiangsi also drains into the Yangtze. Others are the Tai and the Hungtze lakes in Kiangsu.

Since the chief rivers of China run from west to east, the country, particularly in the more densely populated south, is intersected by a network of canals facilitating north and south communication by water. The most important of these is the Grand Canal, connecting Hangchow with Peking (Peiping); about 1,000 miles long, it was built in sections between the 5th century B.C. and the 13th century.

Climate.—China lies almost entirely in the temperate zone, but because of its position on the eastern edge of the continent of Asia, it apparently enjoys the coolest climate for its latitude in the world. Nevertheless, China is warmer than the United States and the nations of Western Europe. The climate is a result of three factors: seasonal winds, cyclonic storms, and tropical typhoons. In the winter a high pressure area centers in Siberia with a cold dry wind blowing from the northwest. Days are, in the main, bright and cloudless in north and west China, but in the Yangtze Valley and south China winter is a gloomy period. In the summer the high pressure area moves out over the Pacific, and the prevailing winds blow from the south or the southeast, heavily laden with moisture. Experiments at Nanking in 1930 and 1931 indicated, however, that both winter and summer winds did not extend above 5,000 feet. Above that altitude westerly winds prevailed throughout the year.

Superimposed on the seasonal winds are the cyclonic storms similar to the areas of high and low pressure which move across the United States. They travel from west to east across China, some apparently having formed in high Central Asia and others having originated in Europe. In the winter and spring they are most numerous in the Yangtze Valley, but in July and August they sweep across north China. Though few yield an abundance of rain, the joining of cyclonic storms moving from the west and the prevailing moisture-laden winds from the southeast is productive of rainfall. In winter the storms encounter the dry winds moving down from the northwest, causing a cold wave.

Of the typhoons of the Western Pacific, most of which originate near the Marshalls and the Carolines, four or five annually strike China's mainland. They move toward Kwangtung in May but by July and August are hitting the central coast; after October the prevailing northwest winds tend to keep them out at sea. Accompanied by rain squalls blown by a high wind, the typhoons often cause severe damage. These three meteorological factors, together with the topography and the nearness to the sea, determine the climate of any given place in China.

China has a great range of temperature from north to south which the north winds in winter and the south winds in summer tend to exaggerate. The mean January temperature for Lupin (Manchouli) is -14.8°F. and for Amoy, 56.8°F. , a difference of 70°F. The mean July temperature for Lupin is 69.8°F. and for Amoy, 84.2° , only 14° difference. Mean temperatures for both January and July rise steadily from Peking southward along the coast: Peking, 23.7° and 79° ; Tsingtao, 29.5° and 74.5° ; Shanghai, 37.7° and 80.8° ; Nanking, 36° and 82° ; Hangchow, 39.2° and 83° ; Canton, 55.5° and 83.5° .

The interior cities of Sian, Hankow, Chungking, and Changsha have a mean July temperature about the same as Amoy, but the mean January temperatures fall considerably lower, to 30.6° in Sian and 46° in Chungking. The heat and relatively high humidity makes China south of the Yangtze uncomfortable in summer.

With moisture-laden winds blowing from the south and southeast, the greatest rainfall occurs in the coastal provinces in that section of China. Canton has 65 inches annually; Hangchow, 58; Shanghai, 44; and Nanking, lying inland, 38. To the north the rainfall steadily decreases with 25 inches at Peking, 21 at Pinkiang (Harbin), and 14 at Lungkiang (Tsitsihar). Lupin, on the western side of the Great Khingan Shan, has only 9 inches a year. The Yangtze Valley has sufficient rainfall (Chungking gets 43 inches annually), but the Hwang Ho Valley, cut off on the south by the Chinling Shan, has a precipitation of only 20 to 25 inches a year. Large parts of Mongolia and Sinkiang are deserts, but Tihwa (Urumchi) in northern Sinkiang has 13.5 inches of rainfall a year. Snowfall is, in general, light in China because the winter months are dry; rare in the south, it occasionally occurs north of the Yangtze Valley.

The crop-growing season varies in length from the entire year in the south, to 8 or 9 months in the Yangtze Valley, 7 months in the more northerly Hwang Ho Valley, 6 months in Hopeh, 5 in Manchuria, and only 4 in Tibet with its two-mile or more elevation.

Population.—There has never been a census of the entire population of China and consequently any figure given for the total number of inhabitants can be only an estimate. According to the Directorate of Statistics of the national government of China, the population of China in 1947 was 461,406,285, distributed as shown in Table 1. (In mid-1948, the official estimate was 463,493,418.) Populations of the principal cities were given as follows: Nanking, 1,037,656; Shanghai, 3,853,511; Peking, 1,602,234; Tientsin, 1,679,210; Tsingtao, 752,800; Chungking, 1,000,101; Mukden (Shenyang), 1,175,620; Hankow, 749,952; Canton, 1,276,429; Sian, 523,183; Pinkiang (Harbin), 760,000; Talien (Dairen), 543,690. About 26,000,000 non-Chinese-speaking people, most of whom live in the northwestern, southwestern, and northeastern provinces, are included in the population figures. At the end of 1947, an official estimate gave the number of overseas Chinese as 8,721,204. Of these, 8,379,720 were in various countries of Asia, 53,759 in Europe, 63,835 in Oceania, 14,851 in Africa, and 209,039 in North and South America (77,504 in the United States¹).

Fauna and Flora.—The fauna of China is widespread and varied, though a large proportion of the larger mammals are found in the north and west. There are several species of deer among which the roe, musk deer, and sika have been hunted in the past by foreigners in the mountains of northern Shansi and Mongolia. Wapiti and antelope, as well as the wild sheep, wild ass, and wild boar, also excite the Western sportsman's enthusiasm. North China and Manchuria are the home of many fur-bearing animals that have commercial importance. Among these are the badger, sable, marten, mink, weasel,

¹ According to the 1940 census, which listed 40,262 as native and 37,242 as foreign born

wolverine, otter, fox, several kinds of squirrels, marmot (thought to be the means by which pneumonic plague is transferred), and the raccoon dog, an animal resembling but slightly smaller than the American raccoon, which produces a fur called on the market Chinese coon. It is said that in normal times more fox skins are shipped from the port of Tientsin than from any other port in the world. Bears in China include the Tibetan black bear, the Manchurian black bear and grizzly, and the giant panda, found in Kansu, Tibet, and Szechwan, specimens of which have been brought out of China for zoos in the United States. Other carnivora, besides those already mentioned, are the tiger, manul, leopard, and the Chinese wolf. There are several kinds of monkeys.

Fully one half of all the species of mammals in China are rodents. Many varieties of rats, mice, chipmunks, gophers, squirrels, and hares abound. Insectivora are few in north China on account of its dry climate, but central and west China are the habitat of many moles, hedgehogs, and shrews. Amphibia are represented by several species of toads and frogs, some like those of Europe. There are many species of snakes in China, most of them of nonpoisonous varieties. Among the venomous species is the cobra, which differs slightly from the Indian variety. Turtles and tortoises are well represented, the latter being a sacred animal and an emblem of longevity. The Chinese alligator, smaller than its congener in the Western Hemisphere, rarely reaches more than six feet in length.

An important item in the diet of many Chinese is fish. Shad, perch, bass, sturgeon, a variety called perch pike, and loach, found in mountain streams, are said to be the most edible. However, many other kinds are also used for food.

China is particularly rich in birds. Of the birds of prey several kinds of owls, hawks, falcons, and eagles abound. The vulture, buzzard, and carrion crow represent the scavengers. There are several varieties of pheasants, some of them very beautiful birds, though all characteristically have white collars. Other game birds are the partridge, quail, plover, and woodcock. Water birds are particularly numerous; the most interesting, at least to Westerners, is the cormorant, which has been domesticated and trained to catch fish. Attached to a long string and with a ring around its neck, the bird dives in at the sight of a fish and with its prey is hauled up by the fisherman. Other water birds are ducks, pelicans, geese, herons, bitterns, cranes, storks, gulls, terns, and ibis. Representative of the songbirds are the thrush, bulbul, and lark. There are several species of doves and pigeons, and woodpeckers, swifts, nightjars, ravens, starling, finches, sparrows, swallows, martins, wrens, orioles, buntings, and bramblings are all represented.

Of the domesticated animals of China, only three are important as productive: pigs, sheep, and goats. Cattle are raised, but in very small numbers, chiefly for the consumption of Moslems or resident foreigners. Draft animals in north China include camels, donkeys, mules, oxen, and to a lesser extent, horses. In the far north, however, the Mongolian horse, bred in rather large numbers, is necessary in the activities of the Mongols. In the mountains of the southwest Chinese ponies, little larger than the Shetland, are raised for difficult transportation work. The

water buffalo is used in south China for plowing.

China has the largest flora of all the temperate zone countries. It is the original home of many plants, some of which North America received by way of Europe, such as the peach, apricot, hemp, certain kinds of ginger and rhubarb, tea, sarsaparilla, and many citrus fruits. Trees cut for timber grow chiefly in Manchuria, the southeast coast and the southwestern provinces. These are pine, spruce, larch, elm, birch, oak, and fir. Other trees, less important for the lumbering industry, are the cedar, poplar, willow, alder, ash, maple, gingko, and in the warm south, the rosewood acacia, banyan, and sago palm. All kinds of melons are grown and fruit trees include the peach, apricot, several varieties of cherry, pear, occasionally the plum and in the subtropics of the south the orange, lime, loquat, pomelo, pomegranate, mango, persimmon, fig, olive, litchi, and even the banana. Apples grow in China, though they are large and white or small and red like crab apples, and not the delicious fruit of the northern United States. Among nut trees the walnut, chestnut, and pistachio are common.

Food plants consist largely of cereals and vegetables, though the use of various soybean products is becoming widespread. In north China wheat, sorghum, barley, millet, corn and a little rye and oats are grown. Rice is the staple in the south. Vegetables are varied and range from the potatoes, sweet potatoes, eggplant, yams, turnips, carrots, onions, cucumbers, beans and peas, all of which are common in the United States, to several varieties of greens and cabbage and lotus bulbs. Fiber plants include ramie, known commercially as China grass, and cotton, both of which are exported, and flax, hemp, and some jute. Large quantities of tea grow in the lower Yangtze Valley and Szechwan. Much of it is exported, some being made into bricks for sale to the Mongols. Tobacco, sugarcane, and the mulberry, on the leaves of which silkworms feed, are all grown commercially. Perhaps of all plants in China the bamboo has the most varied uses; from it are made many articles which range from mats and baskets to tobacco pipes, ladders, musical instruments, and chopsticks, while the sprouts are used for food. Important oil plants are sesame, rape, peanuts, also used as a food, and the seeds of the tung oil tree, used in the making of paint and varnish. Cassia, ginseng, and ma-huang, from which ephedrine is extracted, are medicinal plants.

Among the flowering plants and shrubs are the rose in varieties, and the lilac, peony, orchid, oleander, chrysanthemum, morning glory, iris, lily, honeysuckle, wisteria, water hyacinth, lotus, poppy, one variety of which has been important as the source of opium, gardenia, camellia, and many varieties of azaleas.

Geology.—Underlying all China are the Paleozoic crystalline formations which are the foundation of the continent. They reach the surface in only a few places, among which are Tibet, where loess deposits, sand, gravel, or Mesozoic deposits cover the ancient rocks; the eastern coast provinces of Kwangtung, Fukien, Chekiang, and Shantung with their bleak mountains of granite; and Inner Mongolia, where the ancient formations are partly covered by Tertiary deposits. The secondary deposits of limestones, sandstones, and shales were laid down between the ancient land masses as continental and par-

ticularly marine sediments from the beginning of the Paleozoic through the Jurassic. Northeast China was uplifted by the Carboniferous period, but the rest of China Proper was subject to recurring marine incursions until the Jurassic period. Most of the mountains north of the Yangtze are apparently the result of gentle folding at the end of the Jurassic or the beginning of the Cretaceous and intense folding and thrusting at the end of the Cretaceous. Perhaps the mountains south of the Yangtze were a result of the same action, though the geology is too imperfectly known to say definitely. In the west the Altai Mountains were formed by faulting while the Tien Shan, Kunlun, and Himalaya ranges were the result of folding. During the Carboniferous and Jurassic periods important coal deposits were laid down. In the north an important surface feature is the layer of yellow earth called loess, believed to have been carried in by the winds from Mongolia and Central Asia beginning with the Eocene period. The large alluvial deltas built up by China's great rivers tend to offset the sinking coast, particularly apparent in the southwest, where fiords extend into the land and many islands lie offshore.

Minerals.—From the time of the first travelers from Europe the belief has been widespread that China has a tremendous mineral wealth. Geological surveys, conducted since the establishment of the republic, have revealed that no such reserves exist, with the possible exception of coal. There are three areas in China in which much of the mineral wealth lies: the mountains between the Hwang Ho and Yangtze, the hills south of the Yangtze, and the southwestern provinces. Until the war with Japan forced the government to move west in 1938, adequate surveys of the southwest had not been made, but they were carried on in the course of the war.

According to the *7th Special Report* (1945), of the National Geological Survey of China, China has a coal reserve of 265,314,000,000 metric tons, of which 98.95 per cent is based on actual geological survey. Three fourths of this is in the northwestern provinces of Shansi (47.92 per cent) and Shensi (27.12 per cent). All provinces have some coal, but the remaining 25 per cent is largely in the north and northwest. Because the large deposits are distant from the coast, from metal deposits, and from large centers of population, production areas bear little relation to the location of reserves. Of the 18,158,000 metric tons produced in 1946, the two coastal provinces of Liaoning and Hopeh produced more than one third, while Shansi and Shensi produced less than 9 per cent of the total output. Other provinces which produced more than 1,000,000 metric tons of coal in 1946 were Szechwan (1,800,000), Honan (1,000,000), and Jehol (1,500,000). Formosa, in 1950 the only considerable piece of territory in the hands of the Nationalists, produced another 1,000,000 metric tons. Total production in 1948 was estimated at 13,800,000 metric tons.

China has a total known iron ore reserve of 2,150,511,000 metric tons, of which 91.91 per cent is based on actual geological survey. The province richest in iron, though much of it is low-grade ore, is Liaoning, with 64.38 per cent. Hopeh (6.63 per cent), Fukien (4.29 per cent), and Chahar (4.15 per cent) follow next in order. The quality of Chinese iron ore is generally poor.

About 32 per cent of the total iron reserve has a metallic content of more than 50 per cent (ore of this type is found largely in Chahar, Fukien, Kweichow, Sikang, Hupeh, and Shansi), while 59 per cent of the total reserve has a metallic content of below 50 per cent (all of Liaoning's ore is of this type). The quality of the remaining 9 per cent is as yet unknown. Before and during the Sino-Japanese War, the Japanese operated all the iron mines in China except those in the southwest. Production after the war was slight. In 1946 and 1947 the output of pig iron for all of China was but 31,000 and 35,733 metric tons, respectively.

Petroleum is conspicuous by its absence over most of China, and geological factors make the discovery of a major field unlikely, although there are possibilities in the far west—in Kansu, Sikang, and the eastern and northern rims of the Tibetan plateau. The National Geological Survey estimated the total reserve of petroleum at 206,666,000 metric tons, distributed as follows: Sinkiang (120,000,000), Kansu (60,000,000), Shensi (20,000,000), Chinghai (5,000,000), and Szechwan (1,000,000). There are oil shale deposits in Jehol, Chahar, Shansi, and Shensi, but the biggest is in Liaoning. This shale contains only 5 per cent oil, and its economic value is due to the fact that it overlies the coal seams which must be stripped for mining. Consequently the cost of producing the oil is nominal. In 1942 the Japanese produced 700,000 metric tons of oil from the shale deposit at Fushun, Liaoning.

The production of gasoline and kerosine from natural oil in China mounted steadily after 1939. In 1947 it amounted to 7,800,111 gallons and 4,002,258 gallons, respectively.

Resources in copper are poor, although this metal has been used by the Chinese for various purposes for over three millenniums. The two leading centers of production are in northern Yunnan (about 500 metric tons a year) and southwestern Szechwan (about 100 metric tons a year). Another 347 metric tons (1946) are mined elsewhere, copper ores existing in almost every province, though of poor grade and of limited amount. According to the National Geological Survey, the total copper reserve in China is 967,370 metric tons.

In contrast, the country's resources in tungsten and antimony are superlative. The main reserves, located in the southern provinces of Kiangsi, Hunan, Kwangtung, and Kwangsi, are 2,035,000 and 3,802,870 metric tons, respectively. Production of tungsten in 1948 was estimated at 9,327 metric tons; of antimony, 3,300 metric tons—much less than before the war.

Resources in other metals range from moderate to fair. Of tin there is a reserve of some 650,000 metric tons, nearly half of which is located in Yunnan. Production of tin ore in 1948 amounted to 4,900 metric tons. Reserves of bauxite and alunite amount to 150,000,000 and 198,991,000 metric tons, respectively. There are also limited deposits of manganese, lead, zinc, mercury, sulphur, and silver, and somewhat more plentiful resources in gold and aluminum. Production of lead, zinc, and gold in 1947 amounted, respectively, to 771 metric tons, 320 metric tons, and 107,030 ounces. All of these figures represented a marked falling off from production a decade before.

Porcelain clay, or kaolin, which the Chinese for centuries have worked so skillfully that the

name China has been attached to the ware, remains an important resource (see section on *Ceramics*). Jade, always highly prized by the Chinese, now comes from Sikang and Sinkiang, though once it may have been found in certain riverbeds of China Proper. Yunnan produces emeralds, amber, agates, rubies, and sapphires.

Agriculture.—China has always been an agricultural country, and even now three fourths of the population are farmers. In the days of the empire the importance of farmers was recognized by considering them as the second class of subjects, ranking only below the scholars. Furthermore, the emperor himself gave dignity to their work by going to the Temple of Agriculture each year at the beginning of the planting season to plow a furrow and sow some seed; his representatives in the provinces conducted the same ceremony. According to the *China Handbook* (1937-1945), the cultivated acreage in China (exclusive of Tibet and Formosa) is as shown in Table 2.

south and central China. This makes it ~~un~~ and in some cases impossible to use farm animals. The large population provides human laborers for the most menial tasks. As many crops are raised as the climate will permit; in the south usually three a year are grown, but only one summer crop will mature in the north. Constant use of the land necessitates continual addition of fertilizers, the principal ones being ashes, beancake, mud from the bottom of canals, and night soil. The yields per acre are, in general, higher than the world average; nevertheless, China cannot produce enough to feed her population. Every year wheat, wheat flour, rice, and sugar (also tobacco and cigarettes) are imported.

Agriculturally China is divided into two parts by the Chinling Shan. To the north wheat, sorghum, and millet are the staple crops. They are grown on dry fields, though irrigation is practiced in Ningsia and Suiyuan. Actually in much of this region agriculture is somewhat pre-

Table 2—LAND CULTIVATION IN CHINA

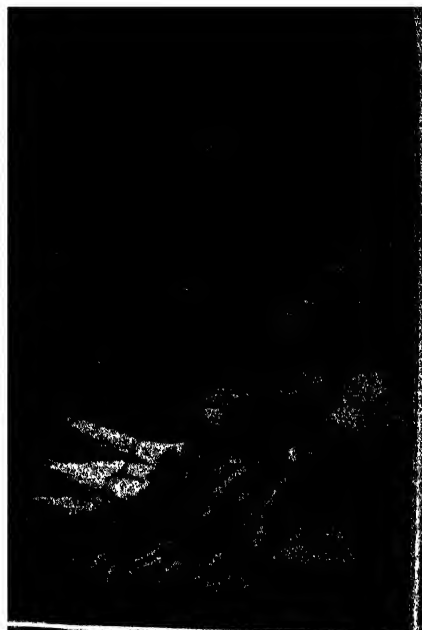
Province	Total land (in 1,000 shih mow ²)	Cultivated land (in 1,000 shih mow ²)	Per cent of cultivated land in total	Average number of shih mow per farm family
Heilungkiang ¹				
Kirin ¹				
Liaoning (Fengtien) ¹	1,932,507	249,018	12.9	62
Jehol ¹				
Chahar	377,530	15,519	4.1	50
Suiyuan	466,567	17,178	3.7	69
Ningsia	350,065	1,847	.5	34
Chinghai	792,128	7,808	1.0	46
Kansu	584,056	21,667	3.7	27
Shensi	279,985	30,870	11.0	22
Shansi	257,060	55,812	21.7	30
Hopeh	206,891	95,323	46.1	23
Shantung	219,457	101,986	46.5	17
Kiangsu	163,216	84,482	51.8	17
Anhui	217,073	49,316	22.7	18
Honan	276,877	104,123	37.6	21
Hupeh	288,906	56,227	19.5	14
Szechwan	591,264	88,724	15.0	18
Yunnan	592,464	24,998	4.2	18
Kweichow	260,780	21,197	8.1	18
Hunan	325,577	42,036	12.9	11
Kiangsi	271,736	38,366	14.1	12
Chekiang	144,635	37,978	26.3	12
Fukien	188,771	21,464	11.4	13
Kwangtung	339,742	39,124	11.5	11
Kwangsi	278,913	29,893	10.7	13
Total	9,406,200	1,234,956	13.1	20.2

¹ From *Japan-Manchukuo Yearbook*, 1941.

² 1 shih mow = $\frac{1}{3}$ of an acre.

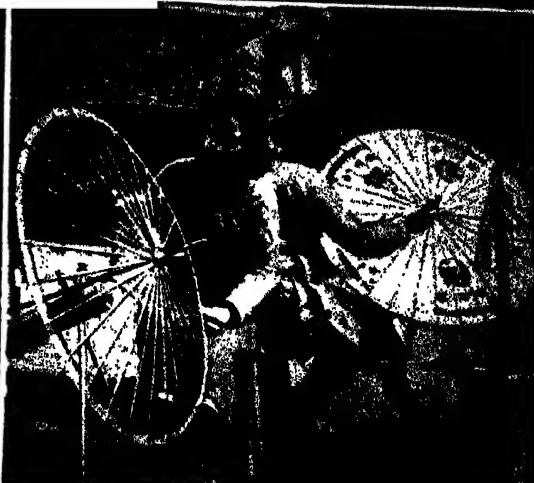
Because of the pressure of the large population in China, almost all cultivable land is now tilled; even hillsides where the soil is not too thin are terraced and planted. This is a characteristic feature of all the Szechwan Basin, where the terraces often extend to the very hilltops; except in the deltas nearly all rice paddies are terraced though they do not reach far up the hillsides in south China because the soil is thin. There are few meadows, orchards, and wood lots, and even animals, except chickens and pigs, which forage for themselves, are not raised in any numbers for food because the cereal crops are needed for human consumption. Even so, a crop failure may cause widespread suffering, partly because adequate means of transportation are not available to bring in food from more productive areas. Chinese farming has been likened to gardening because it is highly intensive. The farms are small (the average for all China is 3.3 acres), but even then they are likely to be cut up into nonadjacent plots, especially in

carious because of a light rainfall, but the moisture-retaining quality of the loess tends to ameliorate conditions slightly. In Manchuria and the provinces along the northern border wheat is planted in the spring, since only one crop can be raised during the year. In a belt of provinces lying across China west of Hopeh and Shantung wheat is planted in the winter so that a second crop may be raised in the summer. Other important crops in this area are barley, oats, flax, peas, soybeans (particularly in Manchuria), hemp, cotton, tobacco, peanuts, corn, sesame, and rape. In addition, all kinds of garden vegetables including sweet and Irish potatoes, carrots, onions, cabbages, string beans, and peas are grown. Melons, pears, and persimmons grow on the North China Plain, and Kansu produces excellent apricots and peaches. Shansi, Shantung, and the Liaotung Peninsula produce some silk but the worms are fed on oak rather than mulberry leaves. In general, there is not so much hand labor as among the farmers of south



Everyday life in China. Top left: A "wei chi" player in a Cantonese tea house attempts to encircle some of his opponent's pieces. Top right: Shopping at a fresh vegetable stand. Center left: Three generations of Chinese spinning wool. Center right: Making umbrellas for a Y.M.C.A. cooperative in Chungking. Bottom: Manchurian workers repairing a locomotive.

(Top left, bottom) Triangle Photo Service; (right) Guillumette (CNS); (center left, right) Indusco, Inc.



CHINA



CHINA Top: The city of Amoy (or Szeming), in Fukien Province, southeastern China. Center: Kweilin, on the banks of the Kwei River in the Province of Kwangsi. Bottom: Looking west on the Bund of Shanghai, China's largest city.

(Above, below) Indusco, Inc., New York; (bottom) Paul Guilleumette, Inc. (CNS)



China, and mules, donkeys, and oxen are used for plowing. Only in Manchuria is farming done on a large scale with modern machinery.

In the south, rice is the staple crop, though winter wheat is grown in southern Szechwan, Hupeh, southern Kiangsu, and northern Chekiang. In other provinces two crops of rice are grown. The water buffalo, the principal farm animal, is used for plowing the paddy fields, but rice culture necessitates a tremendous amount of hand labor. Tea is grown in the hills which form the Fukien-Kiangsi border, in western Chekiang, in northwestern Kiangsi, and in Szechwan. At the turn of the century China supplied more than 40 per cent of the world's tea, but by 1925 only a little more than 10 per cent came from that country as a result of poorer quality and the lack of interest and money on the part of the farmers in improving the grade. Growing mulberry leaves for silkworms is important in the lower Yangtze Valley, in Hupeh, Szechwan, and Kwangtung. Other important crops in south China are beans, tung seeds, bamboo, sugarcane, tobacco, rape, cotton (in the Yangtze Valley) and vegetables of all kinds. In the south and along the southeast coast citrus fruits grow in abundance. Kwangtung and Kwangsi produce litchis, bananas, ginger, and 65 per cent of the world's cassia. On the tableland of Yunnan and Kweichow grow excellent peaches, pears, apricots, persimmons, walnuts, and chestnuts.

Before the Sino-Japanese War the lot of the farmer was a hard one. From a small plot, cultivated almost to the economic limit, he secured enough for only the bare necessities of life. He himself had no capital for improvement, and at his death the land passed in even smaller plots to his sons. To combat this tendency the government set up a long range agricultural policy which includes scientific farming, large-scale farm management, industrialization of rural districts, commercialization of farm products, and a better rural system. Although putting the policy into operation has been retarded by the war, the government has, nevertheless, made a beginning. Irrigation projects completed up to the end of 1947 should bring water to a total of 7,589,494 shih mow of land, over half of which is located in the northwest. Further, the National Bureau of Agricultural Research established several regional substations for crop improvement. These included, in north China, nine field stations for wheat, rice, cotton, sweet potatoes, and other crops; in the southwest, three field stations for tung oil trees, tea, and Irish potatoes; in Hunan, Kwangsi, and Shensi, three field stations to co-operate with the provincial agricultural improvement bureaus with respect to rice, sugarcane, wheat, cotton, and other crops; and in Fukien, a tea experimental station. Extension work for the purpose of distributing improved seed and stock has been established in the various provinces.

In 1947, in the whole of China, 42 per cent of the farmers owned their land, 25 per cent were part owners, and 33 per cent were tenants.

Industry.—Before the Sino-Japanese War almost all of Chinese industry, having developed as private enterprise, was concentrated in cities along the coast, or on the Yangtze River. After the outbreak of war in 1937, some 639 factories and plants moved to the west. These included the following industries: iron and steel, chemicals, textiles, machine making, electrical, and food. After the trek to the west, the Chinese govern-

ment took an active interest in industrial development and by 1942 there were 98 state-owned industrial plants in free China. At the same time private industry expanded in the west so that by May 1942, free China had 1,915 privately owned factories. A third phase of China's wartime industry was the development of co-operatives, of which there were 1,590 by mid-1942. After the war, activities were resumed in large measure in cities formerly occupied by the Japanese. In December 1947, there were registered with the government 15,000 factories with a total labor force of 859,485 workers and a total capacity of 4,129,015 horsepower. In terms of capitalization or labor force, the textile industry ranks first, with 4,543,429 spindles in October 1948.

Transportation.—China's commerce is carried on by means of shipping lines, roads, railroads, and airlines. From ancient times the waterways have been important in the history of communication, the two main river systems being the Hwang Ho in the north and the Yangtze in the south. The rivers flow in a west to east direction and the country is intersected by innumerable canals connecting the natural waterways. The greatest of these is the 1,000-mile-long Grand Canal, running now between Hangchow and Peking, begun about the 5th century B.C. It was frequently extended, notably between 600 and 1300 A.D. In recent times, however, the canal has been allowed to fall into disrepair. Chinese shipping has for some time been handicapped by the inland navigation rights enjoyed by the treaty powers so that the total tonnage of Chinese steamships was only a little more than half a million tons before the war, but by immediate action after the outbreak of hostilities in 1937, the Chinese government was able to save all but an estimated 29 ships (48,359 tons) from the Japanese by ordering all ships to proceed up the Yangtze or to Hong Kong. Since 1937 emphasis has been placed on the development of inland navigation. Ships have been built and new navigation lines have been opened on hitherto uncharted inland rivers. The National Conservancy Commission, established Sept. 1, 1941, surveyed 6,875 miles of rivers and started work on 2,360 miles to make them navigable.

There are two principal shipping companies of China. The more important, the Ming Sung Industrial Company, established in 1924, limited its activities to the Yangtze and Szechwan rivers. At the close of 1942 this company with a capitalization of \$7,000,000 owned a fleet of 87 steamers totaling more than 21,000 tons. The China Merchants' Steam Navigation Company, organized in 1872 as a joint government and commercial enterprise, confined its shipping to coastal ports and Yangtze ports below Ichang before the war. After the fall of Hankow in 1938 its business virtually ceased except for a few small boats in Szechwan waters. The Ministry of Communications purchased the company in 1932. In 1942, plans were laid to develop shipping on the rivers of Szechwan and Hunan. As of June 1947, China had 3,348 steamships totaling 883,483 tons. Of these, 251 steamships with a total tonnage of 143,566 belonged to public institutions, and 2,702 steamships, totaling 481,832 tons, belonged to private companies.

Roads.—Before the republic all but a few of the roads were mere tracks or paths. In 1912 the first highway for motor traffic was con-

structed in Hunan, and five years later the Kalgan-Urga Motor Company built a highway between Kalgan and Ulan Bator (Urga) and opened the first commercial highway transportation business in China. From that time until 1932, when the Bureau of Roads was set up as a department of the newly established National Economic Council, road building was left to provincial government. Between 1932 and 1937 roadbuilding was pushed so that by July 1937 road networks began to take shape in all the provinces, making a total of 71,894 miles of highways in China, 24,990 of which were surfaced roads.

When the war with Japan broke out in 1937, roads became more important than ever before; accordingly the government set up the Bureau of Highways under the Ministry of Communications in January 1938 to oversee construction. By this time the Chinese government was interested particularly in communications in western China, so that motor roads were grouped into three sections: the southwest network with Kweiyang as a center, the northwest network with Lanchow as a center, and the network about Chengtu connecting the first two. Within two and one-half years after the beginning of the war, 2,003 miles of new roads were built and 11,075 miles of roads, hitherto unsuited for motor traffic or fallen into disrepair, were rebuilt. Standards were fixed by the national government: trunk highways were to be at least 39 feet wide; secondary lines, 29 feet wide. In road construction emphasis was laid on international highways and arteries linking provinces in the interior. Besides the Burma Road, there was the important 1,662-mile highway from Lanchow by way of Tihwa to Ayaguz, where it connected with the Turkestan-Siberian Railway. Two other international roads into Indochina, one from Yunnan and another from Kwangsi, finished in 1940, were rendered useless by the Japanese occupation of Indochina. Another important international highway, the Yunnan-Assam road, was opened in January 1945 after the Japanese had been cleared out of the area by the Chinese.

Between August 1939 and the end of 1940 the Chungking government issued 16,429 licenses to nonmilitary vehicles. (Compare this figure with 43,854 vehicles in China in 1932.) Because of the shortage of gasoline, almost all the vehicles, except those in the northwest where there are oil wells, had converted to gasoline substitutes, the commonest being charcoal.

In Chungking on Jan. 1, 1940 the China Transport Corporation was formed by the amalgamation of two smaller companies. In 1944 the company maintained freight and passenger lines in Szechwan, Yunnan, Kweichow, and Kwangsi provinces. One route from Chungking went through Kweiyang to connect at Hochih with the railway to Kweilin; another from Chungking connected at Chutsing (Kutsing) with the railway to Kunming and southern Yunnan. In June 1941 the company had 338 passenger buses, but a year later only about 100 could be used for regular service.

Because irreplaceable vehicles were slowly breaking down and supplies of gasoline were meager, the Chinese government established stage transportation. Various means were used: carts pulled by men or animals; junks, steamers, human carriers, or pack animals including horses, mules, and camels. Up to 1944 six national lines

had been established: Szechwan-Kweichow, Szechwan-Shensi, Shensi-Kansu, Kansu-Sinkiang, Szechwan-Yunnan, and Szechwan-Hunan-Hupeh. There were also almost 19,000 miles of branch lines. In 1941, 1,284,170 tons of freight were transported over the six national lines. As of June 1948, China had 81,966 miles of roads. The total number of licenses issued by the government to nonmilitary vehicles was about 75,000.

Railroads.—Chinese railway history dates back to 1876, when British and American merchants of Shanghai built the 10-mile Shanghai-Woosung line only to have it taken over and destroyed by the Chinese government the following year after the accidental death of a Chinese. That same year Li Hung-chang, viceroy of Chihli, granted permission for the construction of a tramway from the Tongshan-Kaiping coal mines to deep water at Taku. Although the permission was for animals as power, the English engineer Kinder planned for a railway from the beginning and built an engine from material locally available. This short line was extended to Tientsin by 1888 and shortly thereafter in the opposite direction to Shanhaikwan (now Linyu). After the defeat by Japan in 1895, the Chinese government wished to build more railroads, and since capital was not available in China, foreign loans were obtained. European countries were eager to lend China money for construction in their particular spheres of influence, for in some instances China gave a 99-year lease and full control of the railway to the lender. Under this arrangement the Russians built the Chinese Eastern Railway across Manchuria, 1897-1903; the Germans built the Kiaohsien-Tsinan line, 1899-1904; and the French extended the line from Indochina to Kunming, 1904-1910. Over the Belgian-financed Peking-Hankow line, built 1898-1905, the Chinese retained control. About the same time railways were built from Shanghai to Ninghsien and to Nanking, financed by the British. By the end of 1915, China had about 5,400 miles of railways of which all but 570 were north of the Yangtze (including Manchuria) with Peking as a center. Of the 570 miles in southern China branches in two directions from Canton accounted for 119 miles and the Nanking-Shanghai-Ninghsien railway, for 371 miles. By 1931, when the Japanese seized Manchuria, China had approximately 9,300 miles of railways of which about 40 per cent lay in the lost territory. Sections constructed between 1915 and 1931 include: (1) the extension of the Lunghai railway from Tungshan (Suchow) to Tunghai (Haichow) on the coast and to Sian in the west, (2) from Tungkwan on the Lunghai north to Yangku (Taiyuan), (3) from Yangku to Chengting on the Peking-Hankow line, (4) Hankow-Changsha, (5) Nanchang-Kiukiang, and (6) a section north of Canton on the Canton-Hankow line.

In 1936, Chiang Kai-shek drafted a five-year plan for railway construction. The completion of the Canton-Hankow, Sian-Paoki, Hengyang-Kweilin, Wuhsien (Soochow)-Kashing, and the Chekiang-Kiangsi (Hangchow to Lishui on the Canton-Hankow) lines before the evacuation of eastern China facilitated the trek to the west. By the end of 1942 only 10 per cent of the old railways remained in free China, but 750 miles of new railways had been built and 380 miles were under construction in the west. Completed since the outbreak of the war are the Hsienyang-Tungkwan branch of the Lunghai railway, the Kwei-

lin-Liuchow (Maping) section of the Hunan-Kwangsi line, the Liuchow-Hochih branch of the Kweichow-Kwangsi line, and the short Kunming-Chutsing (Kutsing) section of the Ipin-Kunming railway. In 1944 the Kweiyang-Hochih was under construction, but on the following lines construction had been suspended: Chengtu-Chungking, Liuchow-Chennankwan (on the Indochina border), Kunming-Burma, and the Chutsing-Ipin. One more line, the Paoki-Tienschui-Chengtu, had been partly surveyed.

In 1944 only 1,829 miles of railways were in operation in free China, but they were an important means of communication. It should be remembered that the Chinese armies completely destroyed several sections of the Canton-Hankow, Lunghai, and Chekiang-Kiangsi lines by removing the rails and dynamiting the roadbed as a measure of defense. Since the end of the war, however, in spite of civil disturbances many lines were repaired and resumed a measure of service. At the end of 1948 total trackage was 18,757 miles, of which (September 1948) 8,120 miles were in operation.

Airways.—Commercial aviation in China began in 1929 with the organization of the China National Aviation Corporation, a joint Sino-American enterprise. Two years later the Eurasia Aviation Corporation, a Sino-German firm, was organized primarily for the purpose of carrying mail between China and Europe. A third company, the Southwestern Aviation Corporation, existed from 1932 until it was dissolved in 1938; a purely Chinese company, it was subsidized by the provincial governments of Kwangtung and Kwangsi over whose territories its lines passed. Between October 1929, when the C.N.A.C. made its first flight, and July 1937, the two important aviation companies had together built up 8,591 miles of air routes with 30 airplanes of German and American makes operating on the lines. After five years of war, of these original lines, only 584 miles remained in free China, but 5,779 miles of new airlines had been opened, most of them in west China.

The C.N.A.C. before July 1937 operated lines from Shanghai to Chengtu, to Peking, and to Hong Kong through Canton, and a Chungking-Kunming line. As the Japanese penetrated China, all the lines except the last named had to be given up, but fortunately the company lost few planes and was therefore able to open new lines in west China. The following new routes were opened: Hankow-Changsha, 1937; Chungking-Hong Kong, 1937; Chungking-Loshan (Kiating), 1938; Chungking-Hanoi, 1939; Chungking-Rangoon, 1939; and Hong Kong-Namyung, 1940. At Hong Kong, C.N.A.C. had connected with Pan American Airways' transpacific service to the United States and the British Imperial Airways' services to Europe and Australia. With the extension to Hanoi, connection was made with Air France and at Rangoon there was established another connection with British Imperial Airways as well as K.L.M. (Royal Dutch Airlines). Japanese military action eventually made all these lines impossible, save the one from Chungking to Loshan, thereby cutting off all the connections which the company had with foreign airlines. Only 10 days after Pearl Harbor, however, the Chungking-Calcutta route was opened, the last important road linking free China with the outside world. In 1942 the C.N.A.C. added a regular service from Chungking to Lanchow. In

1936, the biggest year of business before the war, its planes flew 1,543,217 miles and carried 15,748 passengers, 190,703 pounds of mail, and 103,484 pounds of freight. After the Japanese attack, the amount of business sharply decreased until new lines could be established in the west. A second blow came when the Japanese took Hong Kong.

The Eurasia Aviation Corporation, from its establishment in 1931 until 1941, when the Chinese government broke relations with Germany, used only German planes and brought in from Germany the air and ground crews and advisers. After 1941 it became a Chinese company. Before 1937 the company established the following lines: Shanghai-Lanchow, Peking-Loyang, Lanchow-Paotow, Peking-Canton, and Sian-Chengtu-Kunming. After war broke out Eurasia moved from Shanghai to Kunming and continued flying in west China, to Hanoi and to Hong Kong. The company was badly hit when the Japanese took Hong Kong in December 1941, for only one plane was saved. One year later, Eurasia flew its four routes with that single plane. Within six months after the close of the war in August 1945, the Chinese government announced plans for re-establishing the airways and rebuilding the roads and railroads. As of September 1948, the country had 97 planes for civil aviation with air routes measuring a total of 55,352 miles.

Government.—Government emerged slowly in China, as elsewhere in the Old World, out of a community and tribal background until by approximately the beginning of the second millennium before our era a single ruling family is said to have dominated an area in the Hwang Ho valley. We learn from the excavation of a single city, which was the seat of government from about 1300 to 1050 B.C., that the next ruling house of Shang had a considerable court which required several government buildings, palaces, temples, and mausoleums. At the top was a king, with whom was associated one or more consorts. He led in matters of war and of religious observance. It was important for him both to defend his area from attack and to conform with nature so that his people might be blessed both with peace and abundance. Besides military and civil officials there were priests who helped him by divining the future, determining the calendar, and supervising sacrifices at proper times.

Toward the end of the 11th century B.C. a new ruling house (the Chou), which conquered the Shang, expanded the area of rule to include both the major river valleys. Its method of government differed from what preceded in that the country was divided into fiefs officered by the king's near of kin, military chiefs, and leading allies. These were ruled with increasing independence throughout the next few centuries, until after 771 the lords paid little more than lip service to their king. Another point of difference was the introduction of the institution of eunuchs, who from servitors in the palace frequently developed into influential advisers and powerful officers of state.

The last king of Chou disappeared in 256 B.C. After a period of anarchy, one of the states contending for mastery (the Ch'in) beat all others into submission and for the first time set up an empire. Feudalism was abolished and the country was divided at first into 36 areas, each with its military governor, civil administrator, and supervising official, all responsible to the em-

peror. Nobility was continued, but instead of being hereditary it was based on services and gifts to the state. Although the house of Ch'in survived only a few years, it created a method of government that was to last for over two millenniums. The thinkers of this age believed in centralization, with the head a kind of patriarch, his officials subordinate parents, and the people children. The ancient system of the family was thus the pattern. Political institutions were not infallible—in fact Mencius defended the people's right to rebel—but the family was (to be unfilial was the supreme sin). Hence during the next empire, that of Han, the system of thought called Confucianism, which supported monarchy of this type, became the favored one of the bureaucracy, and all those seeking appointment studied the Confucian canon.

While laws were made, a sense of justice was considered more important (as in a family); so the empire was actually a government of men rather than one of laws. China's political philosophy cannot better be summed up than in the words of a 19th century British author:²

"(1) The nation must be governed by moral agency in preference to physical force.

(2) The services of the wisest and ablest men in the nation are indispensable to its good government.

(3) The people have the right to depose a sovereign who, either from active wickedness or vicious indolence, gives cause to oppressive and tyrannical rule."

In 1911-1912 this ancient and elaborately developed system was set aside in favor of one largely derived from the West: a republic. The main surviving instrument was that of the hsien or county magistrate, often called the father and mother of his people. After some 15 years of trial and error a new government was formed, in 1926-1928, responsible to a single party, the Kuomintang. While theoretically still existing in 1950, this government had been driven by military action out of China Proper and was limited mainly to the island of Formosa. It was succeeded on the mainland (officially since Oct. 1, 1949) by the People's Republic of China. The leaders of the new group consciously drew upon the writings of Karl Marx for inspiration and patterned some of their techniques of government after those worked out by their powerful neighbor, the USSR.

Representing the people in the new republic is the People's Political Consultative Council or Conference, composed of delegates of all parties, people's organizations, the army of "liberation," and even overseas Chinese. This body is to meet once every three years. Between plenary sessions of the council a National Committee performs all necessary functions. The committee includes a chairman, 6 vice chairmen, and a Central People's Government Council of 56 members, one of whom serves as secretary general. In addition, there is a Military Council, with a chairman and 5 vice chairmen, one of whom is commander in chief of the army, a procurator, a supreme court, and a State Administrative Council. Chairman of the last named, also called premier, is assisted by 4 vice chairmen, 4 commissions (political and legal, finance and economics, culture and education, and control), and 30

ministries ranging from foreign affairs to agriculture, labor, and the inspectorate general of customs. Besides these ministries maintained at the capital, Peking, there are regional military and political committees, appointed by the state administrative council, governing five of the six major regions into which China has been divided: northeast, east, central and south, northwest, and southwest. The five northern provinces close to Peking, which form the sixth region, are administered by the central government.

Education.—Education of the brightest boys in the body politic has long been a concern of the Chinese people. Education of girls has been left to the home until recent years. Adult education is a novelty of the last generation.

Before and after the time of Confucius tutors found employment in the chief centers of population in the Hwang Ho valley, and—if famous—attracted to their academies a considerable following from the youth of well-to-do families. These youth were initiated into the mysteries of rhetoric, history, poetry and prose, ethics, thought, military science, astronomy and mathematics, and such varied fields as divination, music, medicine, law, and existing trades. Different schools of thought flourished in different centers, and brilliant students moved from one center to another. Out of these schools came a considerable literature, much of it produced by the disciples of various masters, not necessarily by the masters themselves.

By the 2d century B.C. there came into being a few higher schools supported by the state, which trained young men in the doctrines upheld by the ruling house and sent them out to become members of the bureaucracy both in the capital and throughout the empire. These schools multiplied and increased their enrollment greatly in the next three centuries. The leading institute at the capital, for example, started with 50 students in 125 B.C.; by the 2d century A.D. it is said to have had 30,000. During the 400 years of disunion which followed, state education suffered, although a number of men became highly educated through private instruction. In this the Buddhist monasteries began to play a conspicuous part. When China was reunited under the T'ang, the following argument was used against them: "The priests arrogate to themselves," said one courtier in 624, "the right to educate the people, withdrawing from the Emperor this right which belongs properly to him, thus diminishing his authority and prestige."

At the beginning of the 7th century there was a resumption of education under imperial auspices stimulated by the system of state examinations through which an aspirant for office had to pass. The two capitals of Sian and Loyang became important centers of learning and many students from all over the nearby Asiatic world flocked there. It has been reported that the National Academy alone boasted 3,260 students in 631 and 8,000 in the 9th century. Besides this academy there were other colleges for the study of various subjects including government, law, calligraphy, and mathematics. Young boys, as in the 1st century B.C., were taught through exercise books of from 1,000 to 1,400 characters which introduced the Confucian ideas of the time in rhymed verse. One closes with the following minatory couplet:

"O children embarking on your studies
Be quick to learn and slow to forget."

² Meadows, Thomas Taylor, *The Chinese and Their Rebelions*, pp. 401-402 (1856).

CHINA, JAPAN, HONG KONG, KOREA, MACAO, MONGOLIA AND THE RYUKYU ISLANDS

CHINA			Formosa (island),			Kiamusze, 168,000.			Manchouli (Lupin)		
Acheng	L	2	6,126,006	K	7	Kian (Luling)	H	6	7,091	J	2
Aichow	G	8	Fowning, 62,144	K	5	Kiangkow (Lungjen)	G	6	Manchuria	K,L,M	2
Aigun	L	2	Fuchow (Linchwan)	J	6	Kiangsu Province, 12,725,187	G	6	Maoming (Kochow)	H	7
Alamdo	D	5	Fukien Province,			Kiangsu Province,			Maoma	F	3
Ala Shan (desert)	F	4	11,100,880	J	6	36,052,011	K	5	Maping (Liuchow),	G	7
Altai (range)	D	2	Funing (Siapu)	K	6	Kiangtzu (Yanchow),			208,447	G	7
Altin Tugh (range)	C	4	Fushi (Yenan)	G	4	127,392	K	5	Mekong (river)	E	6
Ami	F	7	Fushun, 279,604	K	3	Kiaochow	J	4	Mengtze, 193,004	F	7
Amne Machin (mt.)	E	5	Fusin, 166,188	K	3	Kiaohoo	L	3	Minhow (Foochow),		
Amoy, 138,032	J	7	Fuyang	I	3	Kiating (Loshan)	F	6	328,434	J	6
Anhui Province,			Fuyang (Yingchow)	J	5	Kienchang (Nancheng),			Minya Konka (mt.)	F	6
21,705,256	J	5	Fuyu, 64,969	L	2	50,000	J	6	Mishan	M	2
Ankang (Hingan)	G	5	Gartok	D	8	Kienow (Kienning)	J	6	Moho, 1,966	K	1
Anking (Hwaining), 121,379	J	5	Godwin Austen (mt.)	C	7	Kienshui (Linan)	F	7	Mukden (Shenyang),		
Anlu	H	5	Great Khingan Shan			Kiente (Yenchow)	J	6	1,120,918	K	3
Anshan, 165,988	K	3	(range)	K	2	Kingyuen (Ishan)	G	7	Mutankiang, 200,319	L	3
Anshun	G	6	Great Wall	H	3	Kinhwa, 211,140	J	6	Muztagh (mt.)	D	7
Ansi	E	3	Gyangtse	C	6	Kinping (Liping)	G	6	Muztagh Ata (mt.)	C	7
Anta	L	2	Haichow (Tunghai)	K	5	Kirin Province, 6,981,277	L	3	Nanan (Tayu)	H	6
Antung, 271,115	K	3	Hailung	I	3	Kiuchuan (Suchow),			Nanchang, 258,692	H	6
Antung Province,			Haimen, 100,572	K	5	246,873	E	4	Nancheng, 50,000	G	5
3,163,911	L	3	Hainan (island)	G	8	Kiukiang, 137,108	J	6	Nancheng (Kienchang)		
Anyang (Changte), 60,000	H	4	Hami (Qomul)	D	3	Kiukiang (Kukong)	H	7	Nanchung (Shunking)	G	5
Aqu (Wensuh)	B	3	Hangchow (Hanghsien),			Kiungshan	H	8	Nanga Parbat (mt.)	C	7
Argun (river)	J	1	437,522	J	5	Kochow (Maoming)	H	7	Nankang (Tsingtzeh)	J	6
Barkol (Chensi)	D	3	Hankow, 749,952	H	5	Koko Nor (lake)	E	4	Nanking, 1,084,995	J	5
Brahmaputra (river)	C	6	Hanyang	H	5	Kongmoon	H	7	Nanning (Yungning)		
Buti Nor (lake)	J	2	Harbin (Pinkiang), 780,000	L	2	Kukong (Kiukiang)	H	7	202,720	G	7
Bulun Tokhoi	C	2	Heiho	L	1	Kuldja (Ili)	B	3	Nanping (Yenping), 53,445	J	6
(Anton), 1,413,480	H	7	Heilungkiang Province,			Kunghang (Lungsi)	G	4	Nan Shan (range)	E	4
Chahar Province, 2,114,288	H	3	2,563,234	L	1	Kunming (Yunnan),			Nanyang, 50,000	H	5
Chalantun	K	2	Henyang (Henchow)	H	6	293,961	F	6	Ningher (Puerh)	F	7
Chamdo	E	5	Himalaya (range)	C	6	Kwangsi Province			Ninghsien (Ningpo)		
Changchow (Sian), 590,685	G	5	Hingan (Ankang)	G	5	14,603,247	G	7	249,633	K	6
Changchow (Lungki),			Hinghwa (Putien)	J	6	Kwangsin (Shangiao)	J	6	Ningsia Province, 773,325	F	3
56,666	J	7	Hingyin	F	7	Kwangtung Province,			Noho, 12,283	L	2
(Hungchow (Wutsin),			Hofei (Luchow), 70,000	J	5	27,825,512	H	7	Nonni (river)	L	2
125,000	J	5	Hohang (Luichow)	G	7	Kweichih (Chihchow)	J	5	Nunkiang (Mergen)	L	2
Changchun (Hsinking),			Hohow	H	8	Kweichow (Fengkieh)	G	5	Nunkiang Province,		
630,049	K	3	Hokiang Province,			Kweichow Province,			2,407,438	K	2
Changchuen (Shipu)	K	6	1,936,000	M	2	10,518,765	G	6	Pacheng	B	3
Changchep	H	3	Hokien	J	4	Kweihsu, 101,306	H	3	Pakhoi, 36,000	G	7
Changping	J	3	Honan (Loyang), 77,159	H	5	Kweilin, 130,790	G	6	Paksha	H	7
Changshu, 396,465	H	3	Honan Province,			Kweiping (Sunchow)	G	7	Paon	G	4
Changshu, 50,000	H	6	28,473,025	H	5	Kweich (Shangkui),			Paoning (Langchung)	G	5
Changting (Tingchow)	J	6	Hopet Province, 28,528,089	J	4	70,000	H	5	Paoshan (Yungchang)	E	6
Changwu	K	3	Hoppo (Limchow),			Laichow (Yeh)	J	4	Paoteh	H	4
Chaon (Chaochow),			80,000	G	7	Lanchow (Kaolan), 203,722	F	6	Paoting (Tsingyuen),		
179,068	J	7	Huien (Khotan)	B	4	Langchung (Paoning)	G	5	130,000	H	4
Chaotung, 50,000	F	6	Hsinchu (Shinchiku),			Langhin (Yungchow)	H	6	Paotowchen, 62,727	G	3
Chaoyang	J	3	125,120	K	7	Laohekow, 100,000	H	5	Paoying Hu (lake)	K	5
Charchan	B	4	Hsingan Province, 327,563	K	2	Lappa	H	7	Peilingmiao	G	3
Chetoo, 227,000	K	4	Hsinking (Changchun),			Lhasa, 20,000	D	6	Peiping (capital),		
Chekiang Province,			630,049	K	3	Liangchow (Wuwei)	F	4	1,796,517	J	4
19,942,112	J	6	Hsinmin, 64,723	K	3	Liaocheng (Tungchang)	J	4	Penglai (Tengchow)	K	4
Chenchow (Hwaiyang)	H	5	Hualen	K	7	Liaochow	H	4	Pengpu, 105,237	J	5
Chengchow	H	5	Huhing	K	5	Liaocho	H	4	Penki, 98,203	K	3
Chengking	F	7	Hulan	L	2	Liao Ho (river)	K	3	Pingchow (Tuyun)	G	6
Chengteh (Jehol), 60,000	J	3	Hulun (Hailar), 16,140	J	2	Liaoning Province,			Pingchuan	J	3
Chengting	H	4	Hulutao	K	3	9,992,387	K	3	Pingliang	G	4
Chengtu, 727,422	F	5	Hunan Province,			3,798,056	K	3	Pinglu	H	4
Chengyang	J	5	26,171,117	H	6	Liaotung	D	3	Pingwu (Lungan)	F	5
Chensi (Barkol)	D	3	Hunchun, 13,246	M	3	Liaoyang, 102,478	K	3	Pinkiang (Harbin),		
Chenyuan	G	6	Hungtze Hu (lake)	J	5	Lienchong (Tsingan)	J	4	760,000	L	2
Chiamussu (Kiamusze),			Hupei Province, 21,034,463	H	5	Lienkong	K	6	Pinyang (Linfenghsien)	H	4
168,000	M	2	Hwaiian	J	5	Likiang	E	6	Port Arthur (Lushun),		
Chihchow (Kweichih)	J	5	Hwaiking (Tsinyang)	H	4	Limchow (Hoppo), 80,000	G	7	33,000	K	
Chihfeng, 430,000	J	3	Hwaining (Anking), 121,379	J	5	Linan (Kienshui)	F	7	Puchow (Yuntsihien)	H	
Chihkan, 12,000	H	7	Hwaiyang (Chenchow)	H	5	Linchow (Fuchow)	J	6	Puerh (Ningher)	F	
Chihkiang (Yuanchow)	H	6	Hwang Ho (river)	H	5	Linfenghsien (Pingyang)	H	4	Putien (Hinghwa)	J	
Chinghai Province,			Hwangkong	J	5	Linhai (Taichow)	K	6	Qarkhalik (Yehcheng)	C	
1,346,320	E	4	Hweichow (Shehsien)	J	6	Linkiang (Tsingkiang)	H	6	Qomul (Hami)	D	
Chinhwen (Chinchow),			Hweili	F	6	Linshu	M	2	Salween (river)	E	6
148,006	K	3	Hweimin (Wuting)	J	4	Linyi (Ichow)	J	4	Samshui, 9,160	H	7
Chinkiang (Tantu), 216,781	K	5	Hweitsch (Tungchwan)	F	6	Liping (Kinping)	G	6	Sansing	L	2
Chinwangtao, 100,000	K	4	Ichang, 107,940	H	5	Lishui (Chuchow)	J	6	Santai (Tungchwan),		
Chochiang (Charkhlik)	C	4	Ichow (Linyi)	J	4	Luichow (Maping),			70,000	F	5
Chochow	J	4	Ichun (Yuanchow)	H	6	208,447	G	7	Santang hu	D	3
Chuanchow (Tsingkiang),			Ili (Kuldja)	B	3	Lop Nor Basin, Old (salt	L	2	Santaohu	G	3
50,311	J	6	Inner Mongolia	H	3	pan)	D	4	Santaua, 9,000	J	6
Chuchow (Lishui)	J	6	Ipin (Suifu), 76,354	F	6	Loshan (Kiating)	F	6	Shanghai, 4,300,680	K	5
Chuguchak	B	2	Ishan (Kingyuen)	G	7	Loyang (Hanan), 77,159	H	5	Shangiao (Kwangsin)	J	6
Chuho	L	2	Itu (Tsingchow)	J	4	Luchow (Hofei), 70,000	J	5	Shankiu (Kweichih), 70,000	H	3
Chunghsien	G	5	Jehol Province, 6,109,866	J	3	Luichow (Hoihong)	G	7	Shanhaikwan	K	3
Chungking, 1,000,101	G	6	Juichow (Kaolan)	J	6	Lukchun	D	3	Shanshan	D	3
Chungshan (Taiping)	G	7	Juning (Junan)	H	5	Luling (Kian)	H	6	Shansi Province, 15,025,259	H	4
Dairen (Talien), 543,690	K	4	Kaifeng, 303,422	J	5	Lungan (Pingwu)	F	5	Shantung Province,		
Dalai Nor (lake)	J	2	Kaihua (Wenshan)	F	7	Lungchen, 14,000	L	2	38,671,999	J	4
East China (sea)	L	6	Kaitung	K	3	Lungshien (Lungchow),			Shaoing, 177,530	K	6
Ender	B	4	Kaiyuan	K	3	13,600	G	7	Shaowu	J	6
Enshi (Shihnan)	G	5	Kalgan, 151,234	J	3	Lungki (Changchow),			Shasi, 113,526	H	5
Everest (mt.)	C	6	Kamet (mt.)	D	8	56,666	J	7	Shehsien (Hweichow)	J	6
Fangcheng	H	5	Kasut Province, 6,897,781	E	4	Lungkiang (Tsitsihar),			Shenchow (Yuanling)	G	6
Faikong	H	7	Kaolan (Juichow)	J	6	174,675	K	2	Shensi Province,		
Faishan	H	7	Kaohsiung, 186,058	J	7	Lungkow, 10,676	J	4	9,492,489	G	5
Fengkiach (Kweichow)	G	5	Kaolan (Lanchow), 203,722	F	6	Lungsi (Kungchang)	G	4	Shenyang (Mukden),		
Fengyang	G	6	Kara Koram (range)	C	7	Lupin (Manchouli), 7,091	J	2	1,120,918	K	3
Fenyang	J	5	Kashgar (Shufu), 50,000	C	7	Lushun (Port Arthur),			Shigatse	C	6
Fenyanghsien (Fenchow),			Kashing, 102,326	K	5	33,000	K	4	Shihnan (Enshi)	G	6
65,000	H	4	Khanka, Ozero (lake)	M	3	Lwanchow	J	4	Shinchiku (Hsinchu),		
Foochow (Minhow), 328,434	J	6	Khotan Darya (river)	B	4				125,120	K	7
			Ki (Weiwei)	H	4						

Shupu (Changhichen).....	K 6	Tsinan (Licheng), 574,781.....	J 4	Yungkia (Wenchow),.....	K 6	Wakkanai, 34,529.....	O 2
Shufu (Kashgar), 50,000.....	C 7	Tsinchingsien.....	H 4	Yungning (Nanning),.....	G 7	Yakushima (island).....	M 5
Shunking (Nanchung).....	G 5	Tsingchow.....	G 6	Yungping (Liuhsinghsien).....	G 7	Yamagata, 104,891.....	N 4
Shunning (Tengchung).....	E 7	Tsingchow (Itu).....	J 4	Yungping (Liuhsinghsien).....	G 7	Yawata, 210,051.....	M 5
Shunthe (Yingtaisien).....	J 4	Tsingkiang (Chuanchow),.....	J 6	Yungshun.....	G 6	Yokohama, 951,189.....	O 4
Sian.....	L 3	50,311.....	J 6	Yungtsihshien (Puchow).....	H 7	Yokosuka, 250,533.....	O 5
Sian (Changan), 590,685.....	G 5	Tsingkiang (Linkiang).....	H 6	Yunnan Province, 9,171,449.....	F 7	Yonezuwa, 55,008.....	N 4
Siangnan, 82,589.....	H 6	Tsingtao, 787,222.....	K 4	Yunnan Province, 9,171,449.....	F 7		
Siangyang.....	H 5	Tsingtze (Nanking).....	J 6	Yunnan Province, 9,171,449.....	F 7		
Siapu (Funing).....	K 6	Tsingyuen (Paoting),.....	H 4	Yunnan Province, 9,171,449.....	F 7		
Sichang (Ningyuan).....	F 6	130,000.....	H 4	Yunnan Province, 9,171,449.....	F 7		
Sikang Province,.....		Tsining, 150,000.....	J 4	Yunnan Province, 9,171,449.....	F 7		
1,651,132.....	E 5	Tsinyang (Hwaiking).....	H 4	Yunnan Province, 9,171,449.....	F 7		
Si Kiang (river).....	H 7	Tsinyui, 22,321.....	G 6	Yunnan Province, 9,171,449.....	F 7		
Sining, 59,266.....	F 4	Tumen.....	L 3	Yunnan Province, 9,171,449.....	F 7		
Sinking Province,.....		Tungchang (Liaocheng).....	J 4	Yunnan Province, 9,171,449.....	F 7		
4,012,330.....	C 3	Tungchow.....	J 4	Yunnan Province, 9,171,449.....	F 7		
Soche (Yarkand), 57,000.....	C 7	Tungchow (Tali).....	G 4	Yunnan Province, 9,171,449.....	F 7		
Solun.....	K 2	Tungchow (Hweitsch).....	F 6	Yunnan Province, 9,171,449.....	F 7		
Soochow (Wuhsien),.....		Tungchwan (Santai),.....	F 6	Yunnan Province, 9,171,449.....	F 7		
339,517.....	K 5	70,000.....	F 5	Yunnan Province, 9,171,449.....	F 7		
South China (sea).....	J 7	Tunghai (Haichow).....	K 5	Yunnan Province, 9,171,449.....	F 7		
Suchow (Kiuchow).....	E 4	Tunggha, 80,058.....	L 3	Yunnan Province, 9,171,449.....	F 7		
Suchow (Tungshan),.....		Tungien (Kiangkow).....	G 6	Yunnan Province, 9,171,449.....	F 7		
160,013.....	J 5	Tungkiang, 96,652.....	M 2	Yunnan Province, 9,171,449.....	F 7		
Suifu (Ipin), 76,354.....	F 6	Tungliang, 44,110.....	K 3	Yunnan Province, 9,171,449.....	F 7		
Suihua, 36,000.....	L 2	Tungshan, (Suchow),.....	J 5	Yunnan Province, 9,171,449.....	F 7		
Suilai.....	C 3	160,013.....	J 5	Yunnan Province, 9,171,449.....	F 7		
Suteh.....	G 4	Tungting Hu (lake).....	H 6	Yunnan Province, 9,171,449.....	F 7		
Suiting (Tahsien).....	G 5	Tunhua, 33,000.....	L 3	Yunnan Province, 9,171,449.....	F 7		
Suiyang.....	M 3	Tunhwang.....	D 3	Yunnan Province, 9,171,449.....	F 7		
Suiyuan Province,.....		Turfan.....	C 3	Yunnan Province, 9,171,449.....	F 7		
2,166,513.....	G 3	Tuyun (Pingchow).....	G 6	Yunnan Province, 9,171,449.....	F 7		
Sunchow (Kweiping).....	G 7	Tzelutsin.....	G 6	Yunnan Province, 9,171,449.....	F 7		
Sungari (river).....	M 2	Tzeyang (Yenchow).....	J 4	Yunnan Province, 9,171,449.....	F 7		
Sungkiang, 66,663.....	K 5	Uch Turfan (Wushih).....	A 3	Yunnan Province, 9,171,449.....	F 7		
Sunkiang Province,.....		Uliungur Nor (lake).....	C 2	Yunnan Province, 9,171,449.....	F 7		
4,535,092.....	L 2	Urumschi (Tihwa),.....	C 3	Yunnan Province, 9,171,449.....	F 7		
Swatow, 168,154.....	J 7	69,991.....	C 3	Yunnan Province, 9,171,449.....	F 7		
Szecheng.....	G 7	Ussuri (river).....	M 2	Yunnan Province, 9,171,449.....	F 7		
Szechwan Province,.....		Waiyeung (Waichow).....	J 7	Yunnan Province, 9,171,449.....	F 7		
47,107,720.....	F 6	Wanchuan.....	H 3	Yunnan Province, 9,171,449.....	F 7		
Szema, 20,000.....	F 7	Wanghsien, 9,544.....	K 2	Yunnan Province, 9,171,449.....	F 7		
Szenzen.....	G 7	Wansien, 60,000.....	G 5	Yunnan Province, 9,171,449.....	F 7		
Szepingkai, 75,705.....	K 3	Weihaiwei, 175,000.....	K 4	Yunnan Province, 9,171,449.....	F 7		
Tahsin (Suijing).....	G 5	Weihsein, 82,781.....	J 4	Yunnan Province, 9,171,449.....	F 7		
Taiwan, 79,803.....	J 4	Weihwei (Ki).....	H 4				

Naha (capital), 44,779.....	L
Okinawa Gunto (arch.)	L
579,791	L
Ryukyu Is. (U.S. Adm.)	L
917,400	L
Sakishima Retto (islands),	K
43,973	K

Under the Sung an attempt was made, with scant success, to promote more practical training for men seeking appointments in civil service, and public school education was extended throughout the empire. These government schools were partly supported by income from land set apart for the purpose. Primary education was left, as before, largely to private initiative.

This situation obtained without fundamental change until the 19th century, when the influence of Christian missionaries, the example of Japan, and reports from Chinese who had studied in Europe and the United States made themselves felt. Beginning with 1862, when a school was established in Peking for the training of diplomatic personnel, both public and private institutions of a modern type have grown up in all parts of China, particularly on the coast and in the valley of the Yangtze River. A significant step was taken by the Manchu government in 1905, when the time-honored but outworn system of examinations for civil appointment was abolished. By the time of the outbreak of war in 1937 the Ministry of Education reported 294,141 primary schools and kindergartens with 620,693 teachers and 16,629,644 students; 3,264 secondary schools with 26,510 teachers and 571,820 pupils; 108 colleges and universities with 7,560 officers of instruction and 41,922 students. In addition, an uncounted number of people were undergoing short courses in adult education, mainly elementary language (reading and writing) and citizenship.

From 1937 China suffered almost unbearable losses in plant, books, and laboratory equipment, not to mention personnel. The property destruction alone was staggering. In spite of this an astonishing number of institutions transferred their bases to that part of China not occupied by Japanese soldiery, and tens of thousands of students and teachers migrated thither to carry on, in spite of meager facilities and equipment and in the face of swiftly spiraling inflation. It was reported that on Jan. 1, 1943 there were 25 more institutions of higher learning and some 16,000 more students enrolled than in 1937; and that between 1938 and 1943 over 46,000,000 illiterates learned to read simple texts. After 1946 almost all educational bodies returned to their original plants and restored them, in spite of serious deterioration, to some measure of usefulness. As of 1947, there were 290,617 primary schools, with 23,813,705 pupils; 5,073 secondary schools, with 1,566,392 students; and 207 institutions of higher education, with 148,844 students.

Although the country was convulsed in 1949 by civil war and the people were operating largely under an entirely new government, for the most part educational institutions did not suffer physical damage nor did the faculties lose many of their members. On the contrary, a number were enthusiastic supporters of their liberators and were engaged in rewriting textbooks in the political and social sciences. Many thousands of the older students were drawn into government service, but as many more were encouraged to remain at their desks and laboratories to qualify for the many technical and social requirements of the new government. Although in 1950 many changes in emphasis and in subject matter were doubtless in store for the present and next generations of students, meanwhile even church-supported schools, with modifications in curriculum and administration, were encouraged to continue.

Religion.—Religion among the Chinese people began with the first stirrings of communal life in the Hwang Ho valley. Recent finds in Neolithic and Early Bronze Age settlements indicate that they practiced scapulimancy, erected shrines, performed sacrifices, worshiped a variety of gods (including gods of the soil), and that the ruling class, at least, worshiped their ancestors. By the third quarter of the first millennium before our era religious practices and beliefs had been widely extended and formalized, and the greatest religious and moral leaders of the Chinese had appeared. These leaders included those in the *Ju* (Confucian) school: Confucius, Mencius, and Hsün-tzu; those in the school led by Mo Ti; and those in the (Taoist) school of Lao-tzu (Lao-tse) and Chuang-tzu. Of these the only group to set up anything resembling a church were the followers of Mo (who preached the doctrines of mutual love and pacifism); it died about the 1st century A.D. The other schools, however, expanded under governmental and popular support until by the same century and the next they were strongly entrenched and boasted an important literature. To preserve it this literature was frequently carved on stone tablets; in the 10th century and later it was printed and reprinted many times.

In the 1st century Buddhism (q.v.), carried by missionaries from India and nearby Buddhist lands, penetrated China and shortly made a profound impression not only on the hearts and minds of the people, but also on their art and architecture, science, literature, language, and even their indigenous religious institutions. By the 12th century Buddhism had been absorbed, missionaries ceased to come, and its influence generally declined. Confucianism and Taoism—both of which had drunk deep at the well of the Indian faith—superseded it (see CONFUCIUS; TAOISM). Other religious cults which have affected the Chinese are Zoroastrianism (6th to 9th centuries, q.v.); the Nestorian branch of the Christian church (7th to 10th, and 13th to 14th centuries, see NESTORIANISM); Manichaeism (7th to 9th centuries, see MANICHAEANS); Judaism (9th, 11th to 20th centuries); Islam (8th to 20th centuries); Roman Catholicism (13th to 14th, 16th to 20th centuries); the Greek Orthodox Church (17th to 20th centuries); and Protestant Christianity (19th to 20th centuries).

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HISTORY

The actual history of the Chinese begins about 1300 B.C.; for recently excavated materials show inscriptions which permit that approximate dating. Before that time, however, people had lived long on Chinese soil, and had slowly evolved from ancient prehuman types to modern men and women, possessed of a fair degree of culture. That evolution never ceased throughout the centuries to follow. See Table 3 for a chronological chart of Chinese history.

Table 3—CHRONOLOGICAL CHART *

Christian calendar	Outside world	Key facts	Dynasties	Religion and thought	Art	Culture
2000 B.C.	Bronze Age First Dynasty, Babylon	Emergence from Stone Age	HSIA		Black pottery	Domesticated pig and dog Cultivated millet and wheat Potter's wheel Domesticated ox, goat, sheep, horn
1500	Dynasty XVIII, Egypt	Bronze Age		Religion ani- mistic and or- gastic	White incised pottery	Practice of divination Silk culture
	MOSES	Earliest writing	SHANG		Bronze ritual ves- sels and daggers	Wheeled vehicles
	Iron Age	Urban develop- ment			Carved ivory and stone Jades	Cowry shells for currency Brush and ink Composite bow Books of bamboo slips
1000	Rig Veda					Wet rice Fowl Water buffalo
	ZOROASTER	Raids cause shift of capital Feudalism	CHOU	<i>The Odes</i>		Use of rhyme
500	BUDDHA DARIUS	Iron Age First law code Canal and wall building		CONFUCIUS MO TI CHUANG-TZU LAO-TZU LORD SHANG HSÜN-TZÜ	Bronze vessels Bronze mirrors Lacquer Jades Palace architec- ture	Advances in as- tronomy Traction plow Crossbow Round coins Fighting on horse- back Trousers, boots
	ALEXANDER CHANDRAGUPTA ASOKA	SHIH HUANG TI	CH'IN			Iron sword Mule, ass, camel introduced Soybean Football
		Hsiung-nu raids Expansion under WU TI	EARLIER HAN	Civil examinations SSÜ-MA CH'EN Canonical research Alchemy	Garden retreats Wall painting Sculpture	
	JESUS	WANG MANG		PAN KU PAN CHAO		Paper
	KANISHKA		LATER HAN	Buddhist sutras translated Taoism	Glazed pottery	Map of China Tea
	MARCUS AURE- LIUS MANI (MANES)	Buddhism firmly established	3 KINGDOMS			Water mill Sedan chair Use of coal Kite Firecracker
500	ATTILA	South China colonized	TSIN (CHIN) WEI CH'EN CH'U LIANG CHOU CH'EN	Pilgrims to India T'AO CH'EN Chinese nuns	Calligraphy KU K'AI-CHIH Greco-Indian in- fluences in rock temples	
	MOHAMMED	Grand Canal	SUI	Examination system Alien faiths	Tomb figurines	Law code Elephant chess Polo game Block prints
	HARUN AL-RASHID	Expansion to 751	T'ANG	HSÜAN-TSANG	Painting	
		Block printing		HAN YÜ Proscription of Buddhism	Porcelain	
		Foot binding	5 Dyn.	Printing of all can- onical works		Chairs Paper money Ocean ships Compass Cotton Gunpowder Sorghum Abacus Liquor distilled Chaulmoogra oil
1000		WANG AN-SHIH	LI- AO	Classical renaissance Antiquarianism Judaism Drama CHU HSI Mathematics Islam Christianity Lamaism	Landscapes Private gardens Music	
	Magna Carta The Polos	GENGHIS KHAN	CHIN S. SUNG			
		Mongols expelled CHENG HO voy- ages	YÜAN	Encyclopedias Gazetteers	Old and new styles in painting	Spectacles and sweet potato
1500	COLUMBUS	Peking rebuilt Portuguese traders	MING	WANG SHOU-JEN	Colors on porce- lain Underglaze blue and enamel	Peanuts Tobacco, snuff Mexican dollar Opium smoking Factories
		Spanish take P. I. Japanese raids The Manchus K'ANG-HSI era H'YEN-LUNG era Mohammedan re- bellions Taiping rebellion		Fiction Jesuit influence Critical scholarship Dictionaries Libraries Literary inquisi- tion Protestant Christianity Western education Mass education	European influ- ence	Steamships
1950	Two World Wars	SUN YAT-SEN Jap. invasions Communist victo- ries	REPUBLIC		Archaeology	Railroads Motor transport Aviation

Hominids.—The earliest manlike creature whose bones have been found lived before any similar folk who have been discovered to date in Europe, possibly a million years ago. The evidence, which comes from caves of a hill site 37 miles southwest of Peking, shows that he knew how to walk erect, could hunt and slay wild animals, was acquainted with fire, and had developed some skill in making tools out of stone, bone, and horn. He subsisted mostly on meat and may even have been able to speak. See MAN, PREHISTORIC RACES OF—*Peking Man*.

Old Stone Age Man.—In the course of the last 100,000 years the possible descendants of these hominids of the species, called *Homo sapiens*, were spread over a fairly wide area, for their remains have been found by scientists in Manchuria, Mongolia, and north China. Similar evidence has been reported by Russians in Russian Turkestan and Siberia. By this time their craftsmanship had improved, as evidenced by drinking horns cut out of spines, kitchen knives and needles fashioned out of bones, and even shells and teeth made into articles of adornment which have been picked up in sites of their habitation.

Late Stone Age Man.—After several tens of thousands of years human life for a time became intolerable in northern Asia. It was probably because of glaciation in Europe and to a lesser extent in western Siberia, when there were generated winds of great velocity which picked up the good soil in Sinkiang and Mongolia, scattered it over northeastern Asia, and thus formed the Tarim and Gobi deserts and the loess highlands of north China. Where man went in this interval, around 25,000 to 20,000 years ago, we do not know. Some people doubtless found refuge in south China and the Malay Peninsula; others in the Japanese islands; others began the drift into the extreme northeast, and thence to Alaska to begin the peopling of the Americas. By the time the great winds ceased, and the loessification was complete, human beings again returned to China, and began to fish the rivers, hunt in the mountains, and test the soil.

The oldest site so far found (in west central Shensi) is dated tentatively at 6000 B.C. It is characterized by better tools, made of stone, bone, and shell, coarse pottery vessels with pointed bottoms, the bones of pig (the first domesticated animal apparently), and pit dwellings in sufficient number to suggest communal life. For the next 3,000 or 4,000 years men and women in north China, Manchuria, Inner Mongolia, and possibly (to a less extent?) south China developed without significant use of metal, improving their manufacture of tools and pottery, beginning the production of millet, and possibly, toward the end of this period, of hemp, wheat, and dry rice, and domesticating the dog. Among their tools now were a stone-bladed hoe, ax, knife, bow and arrow, a contrivance for spinning thread, and a potter's wheel. While most pots were handmade and gray in color, some (found in the Hwang Ho Valley and to the north) were wheel-made and buff to red-brown in color, frequently decorated with geometric designs, a characteristic common to pots of like antiquity found in Chinese and Russian Turkestan, India, Baluchistan, and Iran. At the very end of the Stone Age a black wheel-made pottery appeared in many sites in eastern China, from the Hwang Ho basin south to Hangchow Bay. The people who devised this ware

lived in small villages near streams and were fundamentally farming folk. Besides the pig and the dog they had other domesticated animals: cattle, sheep, and horses. To heat their homes of circular pits some used oblong stoves. Their diet included shellfish, and they made special use of shells as utensils and decorations.

Bronze Age.—Beginning about 2000 to 1800 B.C. a new development characterized by the use of bronze implements, of wheeled vehicles, and of script is apparent. Whether these were intrusions or not is undetermined, but certainly is possible. All these things had been known for a millennium or two in western Asia and in the Indus Valley. Also about this time the first imperfectly recorded government is said to have held sway in part of the Hwang Ho Valley (the Hsia; approximate dates: 1994–1523 B.C.). Certain bronze vessels, occasionally inscribed with a single character, found in ancient tombs and now deposited in museum collections, may derive from this age. We can only aver that the recent great discovery of the last major capital of the next ruling house (the Shang; dated approximately 1523–1027 B.C.), with its finely executed bronze vessels and weapons, chariots, sculpture, and writing, indicates that there must have been people in China making prototypes during the half millennium or so prior to about 1300 B.C., when the capital was first occupied. The Shang government held sway over an area the limits of which depended on the fortunes of war. It was centered for its last three centuries at a spot near modern Anyang, Honan Province. At the height of its power the area possibly reached from the hills north of Peking to the Yangtze Valley in the south, and from the coast on the east to the neighborhood of Kansu; at its depth the area probably contracted to the immediate region around the capital. It had many enemies on whom it warred frequently, for reasons of self-defense and for tribute of slaves and booty. The government required a considerable bureaucracy and priesthood, put up a number of state buildings and temples, and indulged in frequent religious rites. The king worshipped Ti (an ancestral deity?) and other gods of lesser degree. Through priestly diviners he often consulted the oracle, and hence—as questions and replies were written on tortoise shells or animal bones—a great deal of valuable information concerning the life of the period has been preserved. While the royal household and its retainers hunted, did battle, and performed elaborate ceremonies, the common people probably went on living much as their forefathers had done. Their principal interest still was agriculture; secondarily they were concerned with animal husbandry. A special luxury industry which was developing (possibly among the women particularly) was silk weaving. Besides farmers and cattle breeders there must also have been craftsmen to manufacture articles of stone, bone, ivory, bronze, furs, and pottery (of which a beautiful white variety now appears), and merchants to deal in imported goods. The house of Shang collapsed when a powerful people on the western frontier, in alliance with several other tribes, beat it into submission, destroyed its capital, and scattered some of its adherents to the south, north, and east.

The Chou, 1027–256 B.C.—This people, probably also Chinese, but living on a lower cultural level than those dwelling near Anyang,

had as its ruling family the Chou. They came from the northwest, were inured to war, and possibly lived more off flocks and herds than by farming, at least at first. They installed themselves in the northwest, near modern Sian, and, with the assistance of their allies, ruled a territory even larger than that of Shang at its height. Until the beginning of the 8th century the heads of the house of Chou were able to keep their feudal lords in check and hold the loyalty of the rank and file. Friction then arose, several chiefs defied the reigning king, and in 771 one of them, with the help of an alien horde, rose in successful rebellion. The king was slain, and his court removed to central China near modern Loyang. Kings of the Chou house, however, continued to succeed one another for more than 500 years. Lords of feudal territories appealed to them to settle questions of succession and of religious observance; but their military power, and hence their ability to govern, had come to an end. Their one-time vassals were now the real rulers of China, each, however, in his own domain. At first these states were fairly numerous, but with few exceptions the weaker were rapidly absorbed by the stronger until only those most able to defend themselves remained. This was achieved not merely by force of arms but also by the erection of defense walls, by the art of diplomacy, and by the alliance of several states for varying periods of time. By the middle of the 3d century B.C. the kingdom of Chou was eliminated altogether, the once unimportant state of Ch'in was in a dominant position in the northwest, and other states in the east and in the Yangtze Valley were joined in conflict for complete domination. Ch'in was successful, and launched an era in Chinese government which lasted until modern times.

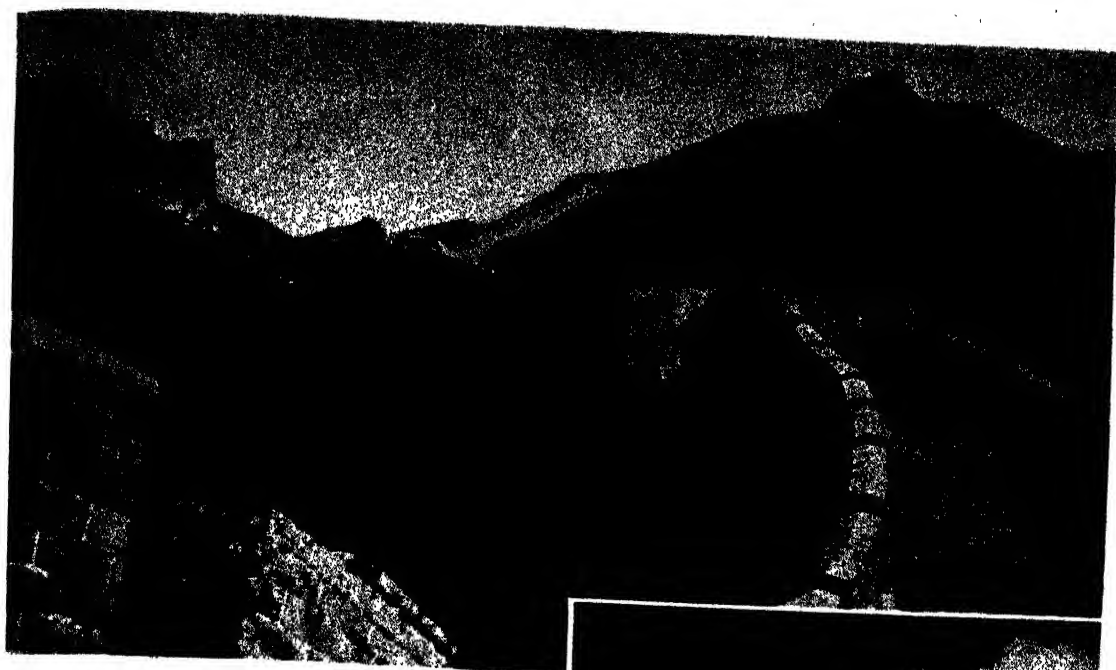
The Chou period has long been regarded by the Chinese as their classical age. Literature, both prose and poetry, then emerged for the first time, the earliest essays at historical writing were attempted, and a wide variety of ideas were set down by schoolteachers, states' advisers, and independent thinkers to baffle and instruct their followers. Most significant (for the future) of the schools which developed as a result of these philosophic utterances were the Confucian, which upheld the standard ethics of the ruling class, the Lao-Chuang (or Taoist), which was individualistic, mystical, and anarchical, and the Legalistic, which promoted ideas resembling the Fascist of modern times. Besides the literary and conceptual, many other developments are to be noted—in agriculture, flood control and irrigation, military techniques, diplomacy, astronomy, and such arts as lacquer, jade carving, bronze mirrors, and gold ornaments.

The Ch'in, 221–207 B.C.—The Ch'in created the first empire. Whether this had Western inspiration we shall probably never know, but there are striking similarities between the creation of the first emperor (Shih Huang Ti, r. 247/246–210 B.C.) and those of Darius in Persia and of Chandragupta in northern India. He abolished the feudal system, and instead divided the country into 36 provincial areas, later increased to 41 as he expanded his dominion. He developed a number of great highways leading to his capital (not far from Sian). Axles of wheeled vehicles were made uniform; so also were laws, weights, measures, and even the way to write. Great public works, some initiated by

his predecessors, were continued; namely, irrigation, canal building, and a long defense barrier, in part connecting older walls, in part new. Taxation, monopolies over iron, salt, and coinage, and conscription of men for labor and military service, all were functions of the central government alone. Members of aristocratic families were forced to move to the capital where they would be under the eyes of the court; much of the literature written before this time was assembled and burned; populations were transferred from one area to another, partly to ward off possible rebellions, partly to fortify and guard the long frontier; merchants were discriminated against in favor of farmers and craftsmen; and the Hsiung-nu (or Huns) in the northwest—long a potent enemy of the Chinese—were made to evacuate the area within the great loop of the Hwang Ho. The rule of Ch'in collapsed on Shih Huang Ti's death, but many of the innovations of this first emperor's house were continued, with modifications, for a long time thereafter. He had embittered the aristocrats, incensed the political theorists, and overburdened the poor; but the people enjoyed unification well enough to make a single China their continuing goal for two millenniums to come.

The Earlier Han, 202 B.C.–9 A.D.—After a few years of anarchy one leader, Liu Chi (or Liu Pang, r. 202–195 B.C.), emerged to establish his family in power. A man of lowly birth, he was nonetheless skilled in military strategy, and not without wisdom in politics. He re-established the capital in the northwest, near Sian, reconquered all but the extreme southland of the Ch'in empire, and sought (after 196 B.C.) for able men to aid him in government. These were for the most part men from substantial families, and were trained in history and in the literature of the Confucian school of thought, which upheld monarchical rule, believed in justice, and strove for order and peace. So conspicuous was their talent for maintaining the dynasty that recruits for the bureaucracy came to be drawn almost wholly from their ranks, a factor which determined the setting up of tests in 165 B.C., and especially after 125 B.C., for their selection. This came to be a distinct and valued, though often over-elaborated, feature of Chinese life later on. The first emperor of the Han dynasty tried not only to pacify the country he had won by force of arms but also to quell the enemies on his frontier. The most formidable of these were the Hsiung-nu. In 201 B.C. they swarmed down over the barrier erected by Shih Huang Ti and would have annihilated the emperor and his army had he not submitted to their terms. It was not until eight decades later that Chinese armies were able to best the Hsiung-nu. During these 80 years the Chinese were intermittently at their mercy and forced to pay tribute in kind. In fact, until fairly modern times, the north and northwest border was constantly an area of great potential danger.

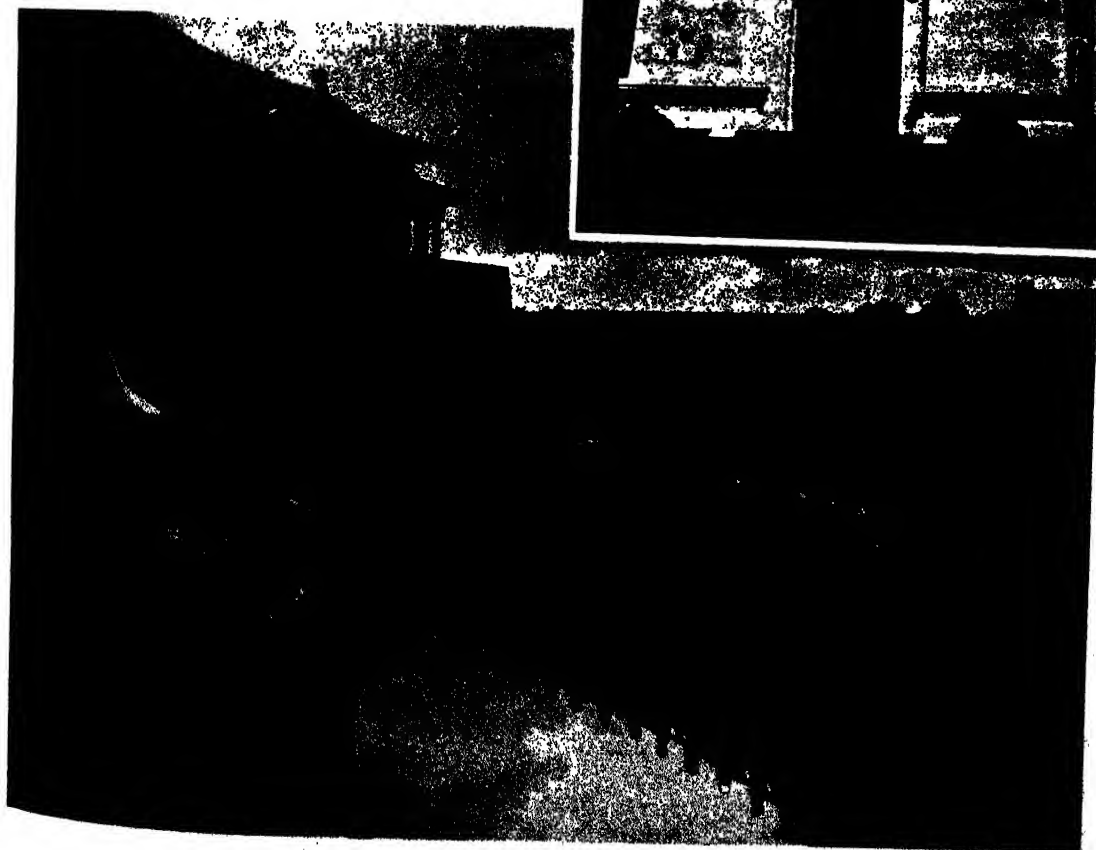
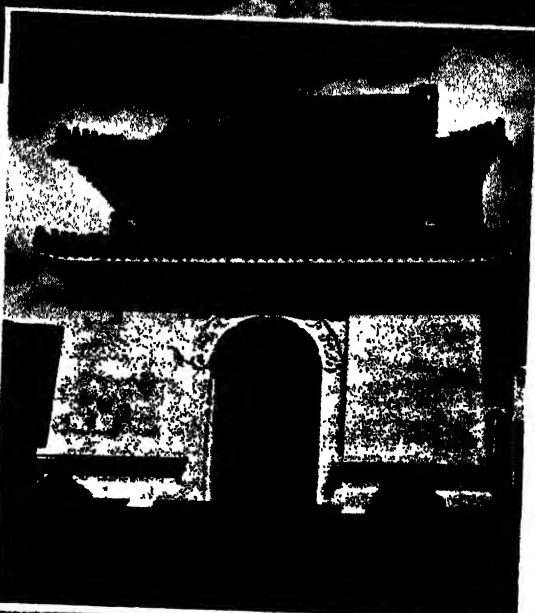
Following the Hsiung-nu, the Turks, Tungus, Tatars, Mongols, and Manchus successively hammered at this gateway. Only the Japanese in recent centuries have been a constant threat to the coast. In the decade beginning 128 B.C. the ruling Han emperor, Wu Ti (r. 140–87 B.C.), sought alliances with central Asiatic peoples against the Hsiung-nu. This effort, though without initial success, brought Chinese envoys, followed by soldiery, into touch with lands and

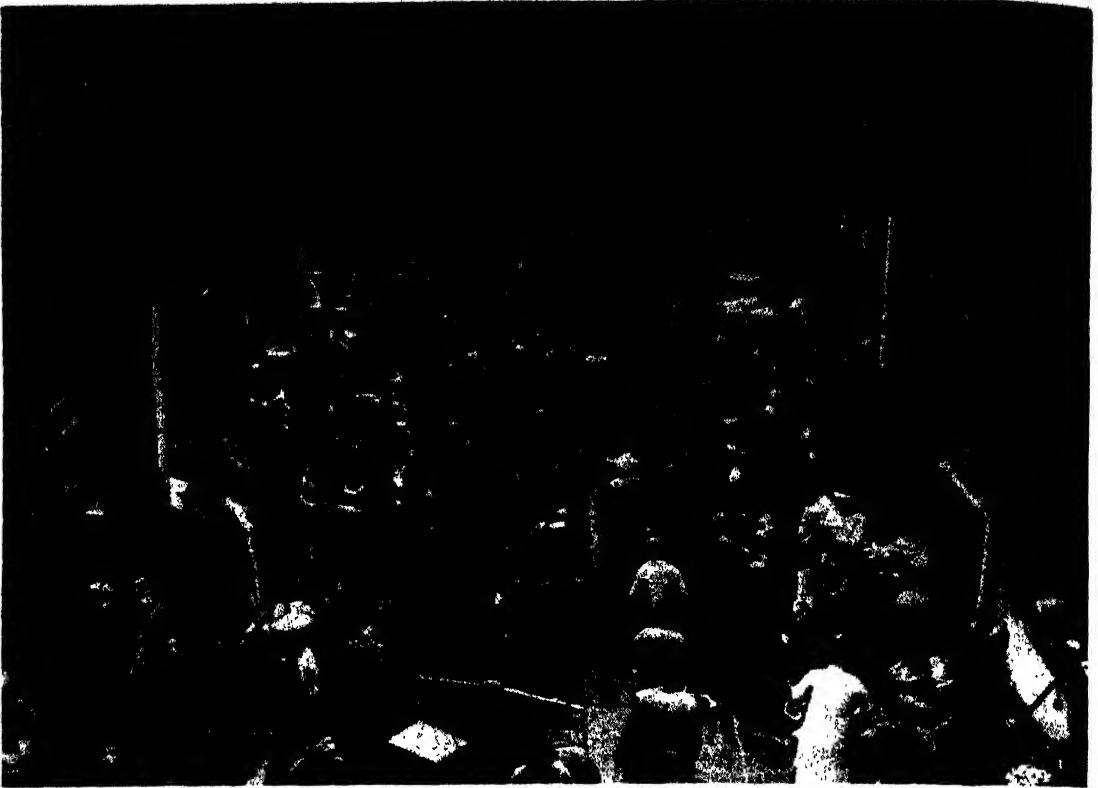


CHINA

Top. Group watch towers along the Great Wall, portions of which were erected as early as the third century B.C. Right: The tomb of Dr. Sun Yat-Sen, China's first president. Bottom in Peiping—a view of the Historic Museum, the former Imperial Palace.

Photographs by: (top) Triangle Photo Service; (right) Paul Gulllumette, Inc. (CNS), (bottom) Sovfoto





CHINA Above: A busy market scene just outside Pishan, a city in the south central Province of Szechwan. Left: Quiet street scene in the town of Pei Pei, north of Chungking. Below: Behind flooded rice paddies rises a small Chinese village.

(Above and left) Paul Gullumette, Inc. (CNS), New York; (below) Triangle Photo Service, New York



peoples in central Asia and western Turkestan, and their reports induced the court to take over as colonies some of the lands of the great corridor leading from China to the Oxus River (now Amu Darya). From this point on, if not hitherto, the Chinese and the people of western Asia were in direct and fruitful, though intermittent, contact. Nor was this the only area of expansion. Beginning 111 B.C. the Chinese reconquered the region around Canton, which the Ch'in had first invaded, and the house of Han sent envoys to many of the lands bordering on the Indian Ocean. Another colonizing force went to the northeast and established a center near modern P'yöngyang, in Korea. In all three of these regions, central Asia, Indochina, and northern Korea, modern archaeologists have succeeded in uncovering indubitable evidences of Chinese settlement in the 1st century before the Christian era.

An Interregnum: the Hsin, 9–23 A.D.—

After two centuries of rule, court and palace politics so weakened the Han that an able minister, Wang Mang, was able to fly in the face of precedent and set aside the titular emperor. By every means within his reach he tried to keep himself in power and raise money for political ends. Word of his difficulties with the moneyed class in due course reached south and central Asia with the result that both colonial regions were temporarily lost to China. After a tumultuous regime he was slain by a merchant, and anarchy again darkened the scene.

Later Han, 25–220 A.D.—A scion of the house of Han became emperor two years after Wang Mang's death, and transferred the capital to Loyang in central China. For some years the government's main concern was the pacification of various parts of the country. Then the empire moved to recover some of its more distant possessions. Tonkin, Annam, and the island of Hainan were subjugated in 42–43 and combined to constitute a province of China; it continued so with but few breaks until the 10th century. During the last three decades of the 1st century small forces pushed their way into Central Asia, forming agricultural colonies which kept in subjection the little states flourishing around the oases, and held the Hsiung-nu and other tribesmen in Mongola at bay. The Chinese even crossed the Pamirs, and for a few years after 90 A.D. exacted annual tribute of the Kushan kingdom ruling in Afghanistan and northwest India during the first two centuries of our era. The settlements in south Manchuria and parts of Korea remained in Chinese hands, attracting occasional visitors from the little known islands of Japan. Direct communication between the Chinese capital at Loyang and the Island Court began in 57, if not earlier. After a propitious start during its first 70 years, the Later Han began to decline when succeeding emperors lost their hold through intriguing eunuchs and palace women. In 184 A.D. the peasants, harried by bad government and by a series of natural mishaps, revolted. During the upheaval which resulted military officers rose to power, and vied with each other for supremacy. In 220 the emperor, for years only a figurehead, was deposed and the fiction of Han extinguished.

So proud have the Chinese been of the achievements of this long period that they often call themselves Sons of Han. The imperial house at its two high points controlled an area greater in extent than ever Rome possessed in its most

flourishing days. To manage this region it developed institutions of government which persisted for a long time. So great did the demand for learning become, largely as a result of the establishment of the civil examinations as a door to official appointment, that 30,000 students are said to have been in attendance at the college of doctors at the end of the 2d century A.D. A great search for the literature of Chou times had been initiated in the 2d century B.C. That literature was copied extensively and commented upon; parts of it became the canon of the two leading schools of thought: the Confucian and the Taoist. Two historians, Ssü-ma Ch'ien (145–?87 B.C.) and Pan Ku (32–92 A.D.), left works which became the first and second of a remarkable series of dynastic histories. Science, music, art, and industry were all enriched by native invention and borrowings from outside.

The Three Kingdoms, 220–280 A.D.; Six Dynasties, 265–589 A.D.—China fell into three parts (Wei, Wu, and Shu) under competing leadership. Difficult living conditions everywhere drove thousands of families to migrate to the less settled areas of the south; forced others into banditry. After 265 one officer arose who attempted unification of power, but it was not for long. The restless tribespeople of the north and west, though constantly at odds with each other, took advantage of the chaos in China to carve great sections of the country out for themselves. Broadly speaking, the Chinese ruled in the south, while men of Hsiung-nu, Turkic, proto-Mongol, and proto-Manchu blood were lords of the north and northwest. The basic population was Chinese, but it became rapidly infused with non-Chinese blood. The bureaucratic government of Han times was in part displaced by barracks rule. Selection of men for office through examination gave way before selection by recommendation and other less expert means. The Confucian way of life, characterized by order and founded on the aristocracy, fell in favor before Taoism, a cult quite as Chinese and based on anarchy. Buddhism, stemming from India and overlaid with Iranian and other non-Indian ideas, penetrated every corner of China and commingled with Taoism until jealous Taoist leaders forced a schism. Politically these centuries are barren; culturally they are rich. Fresh religious experience, new forms of literature, maturing skill in sculpture, painting, and calligraphy, developing uses of paper, invented about 100 A.D., advances in agriculture, shipbuilding, medicine, and other lines of human endeavor tell of the vitality of the age. The end to disunion came when Yang Chien (Wen Ti, r. 589–604), an able officer of one of the northern houses, deposed its boy king, and extended his control to the south.

The Sui, 590–618 A.D.; the T'ang, 618–906 A.D.—Yang Chien's dynasty, the Sui, lasted only two full reigns, but—like the Ch'in before it—left enduring accomplishments. Besides reuniting the different parts of China, it expanded China's borders in the south, invaded Formosa and the Pescadores, sent missions to the East Indies, forced some of the chiefs of the Eastern and Western Turks in Mongolia and Ili into submission, and drove a Mongol-speaking tribe from Kansu into Tibet. Only in Korea were Chinese invading armies repulsed. The Great Wall was refortified, state grain depots were constructed at the western and eastern capitals of Changan and Loyang, which were themselves re-

built, a third capital near the mouth of the Yangtze was brought into being, roads and—even more important—waterways were improved and greatly extended, and a bureaucracy was re-established. The dynasty ended abruptly on the outbreak of a revolt by the Eastern Turks, followed by rebellion at home.

Two high officers, Li Yüan (Kao Tsu, r. 618–626) and Li Shih-min (T'ai Tsung, r. 627–649), father and son, seized the opportunity to establish themselves in power. Their house, the T'ang, carried on the high traditions of the Sui until, after several decades, China reached one of the highest points in its political history. The country was divided into provinces, land redistributed, education popularized, the examinations for civil office were put on the best basis they had ever been, the official religion—starved during four centuries of misrule—was encouraged, canals and irrigation were developed, the laws published. In foreign affairs the T'ang improved China's position in Asia. Protectorates were erected in Korea and Manchuria (668), and both north and south of the Tien Shan (about 657) in Central Asia; relations with princes of Tibet, Nepal, the Indus Valley, Persia, and Arabia signalized the dominance of China in world affairs. Despite signs of weakness this empire's eminence was not seriously challenged until about the middle of the 8th century. Then China suffered a series of heavy defeats in widely sundered regions. The Khitan in Manchuria disputed China's suzerainty on the Liao River, the Uigur Turks drove the Chinese from Mongolia (745), the Thai in the southwest subdued two Chinese armies in 751 and 754, and the Arabs trounced China's viceroy decisively near the Talas River in 751. This gave the signal to dissidents at home. The rebellion of 755–763 nearly prostrated the empire. It recovered some of its dignity for a while, however, though almost none of its wealth and colonial lands. A century later (875–884) another disastrous peasant rebellion, prompted by unjust administration, laid it low, and it was clear that the house of T'ang had run its course. The Sui and T'ang periods are notable for poets, sculptors, painters; for the slow development of printing by means of wood blocks; for the introduction of several religious cults of western Asiatic origin, which, however, were officially banned in the great anti-Buddhist persecution of 845, and but little affected Chinese mores and ethics. The T'ang also greatly influenced neighboring countries, Japan in particular.

The Five Dynasties and the Ten Independent States, 907–960 A.D.—As at the end of the Han, rival military officers struggled for mastery as the T'ang declined. No one proving dominant, the country fell apart. A pretense of empire was continued at the center. The Khitan of Manchuria seized a large area in north China in 907 and held it until 1125. The rest of the country continued in a state bordering on anarchy.

Partly because of these parlous conditions the printing of books of all categories proceeded apace. Literate folk both in secular and religious life did not want their literature to disappear; so they hastened to produce it in quantity and distribute it widely. Once begun, printing became highly popular and resulted in numerous collections of books in monasteries, academies, and the homes of the well to do, a fact which laid the basis for a renaissance in literature in the succeeding era. This in itself almost counter-

balanced the harsh political and social conditions.

The rise of nouveaux riches to power was probably responsible for one innovation which was to curse Chinese women for a thousand years: foot-binding.

The Sung, 960–1279 A.D., and non-Chinese Houses.—The next three centuries saw China again partitioned. Chinese governed in the south and center, but alien chiefs were in power in the west and north. An able civil and military officer of good family, Chao K'uang-yin (T'ai-tsu, r. 960–976) seized power in 960 in central China and consolidated all of the little states in the Yangtze Delta and beyond, as far south as Canton and Hainan Island, into one domain (the Sung). Except for one disaster—in 1126, when the capital at Kaifeng was invaded, the emperor and 3,000 of his courtiers whisked off to exile in Manchuria, and the northern frontier depressed—the Sung lasted for the traditional period of a strong dynasty, kept its enemies at bay with a fair degree of success either by diplomacy (and purchase), or by force of arms, and improved its commercial relations overseas. The Sung Chinese became for the first time a seafaring people to be reckoned with, put the magnetic needle to use on ships, distributed such favored Chinese products as porcelain around the rim of the Indian Ocean, founded new cities, constructed many public works such as city walls, flood controls, and canals, and fostered the arts and, to a less degree, science and thought. In the north the Khitan, a people of Mongol origin, founded the Liao kingdom (907–1125), and not only ranged over north China, Manchuria, and Mongolia, but also treated the Tangut and Koreans as vassals, and had formal relations with Arabia and the islands of Japan. Their administration was in a state of collapse when another rude people from still farther north, the Jurchen, seized the opportunity to strike and ousted them from eastern Asia. The empire which followed for more than a century (1115–1234) went by the name of Chin. On the western flank, near the end of the Great Wall, former Chinese lands were occupied by a Tibetan people, the Tangut, who evolved from a horde into a kingdom around 990, and from that to an empire (the Hsia) in 1032. They were a power in that sector, and sometimes a troublesome and exacting neighbor, until the great Mongol Genghis (Jenghis) utterly defeated them in 1227, and annexed the territory.

All three of these folk when they occupied parts of China were on a lower level of civilization than the Chinese, and to some degree encouraged their own institutions and prohibited Chinese. But the fact of environment served to break down their resolve to remain aloof and unsullied by China's culture. An agricultural economy, and not a pastoral or forest, was clearly required in the Hwang Ho valley, and the village and town complex of the region called for a bureaucracy based on the Chinese model. With these inevitably came the religious and literary institutions of the Chinese, so that, while the people of the north and west generally lagged behind those of the south, important cultural advances were made there as well as under the Sung. The Tangut, for example, built up a literature in their own language through translation from the Chinese, and printed much of it, while the people under Jurchen rule boasted of a large number of playwrights (most of them Chinese) and an active theater at Yenching (modern Peking). In

war they all constituted formidable enemies. They built up excellent organizations of troops, both mounted and foot, and were not slow in trying out and adopting new equipment. It was in this age that the hand grenade and the bombard blossomed from the firecracker and the ballista. The Mongols probably borrowed much of their tactics and matériel from the older and more experienced fighting machines south of the Great Wall, against which they fought before deploying into the west.

The Yüan, 1260-1368 A.D.—The people of Mongolia were a scattered lot of tribesmen during the major part of the 12th century. By 1204 a single man, Temujin, shortly to be called Genghis, had whipped them into a solid, hard-fighting unit. He turned on the Tangut in 1205 and on the Jurchen in 1209. The former became vassals on his death in 1227, and Korea and north China succumbed to his successors in 1231 and 1234, respectively. Sung China constituted the hardest nut to crack, in part because of strong resistance, in part because its terrain was not suited to the type of fighting in which the Mongols excelled. It finally broke, after many bitter sieges, in 1279. So, for the first time in history, did all China come under alien domination. It constituted merely a part of the huge empire of the Mongol khan and first emperor of the Yüan (Kublai, grandson of Genghis, r. 1260-1294), but he liked it so well that Khanbalik (Peking) became his winter capital and he lived in China probably as much as he did in his native land.

With the Mongols were many peoples of foreign birth and training, upon whom they leaned for advice and service. By the same token, they found the Chinese useful in distant parts of their realm, and dispatched them over the imperial highways built across Asia to Novgorod, Moscow, and Tabriz. Chinese engineers improved the irrigation of the Tigris-Euphrates alluvial plain, serviced the catapults and flame-throwing devices in Hulagu's campaign in western Asia, and built the ships which took a branch of Kublai's army to Japan. Chinese paper money for a short while became standard currency throughout the Mongol world. Two branches of the Christian church, the Nestorian and Roman Catholic, together with Islam and Tibet's form of Buddhism, penetrated China. The last two remained after the ousting of the Mongols from China, as their connections with their mother lands held firm; the former withered away as the Chinese sought to remove all taint of the foreigner within their borders.

The Ming, 1368-1644 A.D.—Just as the southern provinces had been the last to fall into Mongol hands, they were the first to rebel. By the 1350's the Yangtze Valley was seething with revolt. By 1368, Khanbalik was reoccupied by Chinese forces, and soon the Mongols were obliged to withdraw on all fronts in the east, from Korea, Manchuria, Yunnan, and even their summer capital of Karakorum. The mighty Timur, or Tamerlane, tried to lead a Mongol army in 1404-1405 in the recovery of China but he died at the head of his troops when halfway across Asia. The rebel Chu Yüan-chang, who became undisputed master of China, was not a man of birth and breeding but, like the first of the Han, one of peasant stock; his parents had given him as a child in time of famine to a Buddhist monastery. He arose to leadership and established his dynasty (the Ming) by craft and brute force. It exercised its power, not only within the wall as far

south as Kwangtung and Yunnan, but also at times in Manchuria and Mongolia, for two and three-quarters centuries.

The third in the line was Chu Ti, the emperor of the Yung-lo period, 1403-1424, who in 1421 moved the capital from Nanking, where it had been established by the first emperor, to Peking. He increased the prestige of China and probably its wealth by sending embassies to neighboring lands (1403), followed by a series of six naval expeditions of unusual size and armament which visited the South Seas, India, and the Persian Gulf. These returned with a number of alien princes, ambassadors, and tribute to the Chinese capital, and collected a considerable body of information both curious and solid for the court. The seventh expedition went out in 1431 and came back in 1433. It was the last. By this time the emperor's advisers had turned isolationist, for reasons today only guessed at. Chinese shipping was confined to coastal waters.

When the Portuguese arrived in the Indian Ocean at the end of the century their principal rivals in commercial transport were the Arabs. The Portuguese touched China, near Canton, in 1514, later harrying the nearby coastal cities. They were followed in 1543 by the Spanish, who penetrated the Philippine Islands in 1565, the Dutch, who moved into Formosa in 1622, and the English, whose trading vessels came to Canton in 1637. Meanwhile, in 1431, Annam had procured its independence, and Japanese (and Chinese) pirates thrived in coastal waters until no port, even on the lower reaches of the Yangtze River, was safe from their depredations. Even the western and northern border became imperiled.

Tibet, after throwing off the yoke of the Mongols, had indicated its independence in 1413. The Mongols defeated a huge invading Chinese army in 1449 and a hundred years later penetrated the Great Wall region. The Russians, advancing swiftly across Siberia, sought contact with Peking in 1567 and again in 1619. The Japanese, resurgent under Toyotomi Hideyoshi, invaded Korea with an eye to continued empire, and were only forced out by Chinese and Korean armies in 1598 after six years of fighting. The Manchus, offshoots of the Jurchen, followed hard after, asserting themselves in the extreme north of their homeland, where they vanquished Chinese armies again and again until, in 1636, Manchuria was wholly theirs, Mukden (Shenyang) their capital, and they were in a position to raid north China with impunity. The court at Peking (the Ming capital after 1421), increasingly under eunuch guidance, was impotent, in spite of wise counsel from loyal statesmen. It aroused the hatred of many elements by playing favorites, misgovernment, heavy and often foolish taxation, hapless conduct of the war in the north, and its failure to suppress piracy on the coast. Civil strife became common in the early decades of the 17th century, concluding with a rebellion which removed some of the western and central provinces from Ming control in 1640-1643. Peking was invaded and the last of the Ming emperors took his life in 1644.

Politically, China was in the doldrums. Socially, intellectually, and culturally the picture was not nearly so dark. A public works program at the outset of the Ming restored China's productivity after the devastation of the anti-Mongol campaign. The rebuilding of city walls

improvement of the system of waterways, construction of countless new bridges, defenses, and places of beauty marked the early decades. The civil service examinations were restored, after a break lasting two or three generations under the Yüan. The planting of sorghum and cotton, both lately introduced from India, was encouraged, and, after the middle of the 16th century, the cultivation of New World plants: maize, peanuts, sweet potato. Tobacco, at first prohibited, made its way against all opposition. Encyclopedias, both great and small, and collections of reprints saved much of antique learning that might otherwise have been lost. New investigations in many fields pushed forward the boundaries of knowledge—in music, language, geography, the classics, *materia medica*. A number of works were printed with movable type, but wood blocks for this purpose were generally favored. Fiction at last came into its own, and the theater developed new genres. Buddhism and Taoism claimed many loyalties but their sun—for men and women of intellect—had practically set. Confucianism set the standard for products of schools and for men in official life. Painting and porcelain were the two chief arts. After the reappearance of Roman Catholicism, first in the south (Macao, 1579), then in the north (Peking, 1601), a number of open-minded Chinese were impressed and affected by the learning and character of the missionaries from abroad. Some were converted; many more were influenced by their writings on knowledge new even then in Europe.

The Ch'ing, 1644–1912.—The Manchus made a full-scale invasion of China only when they saw that its people were hopelessly divided, and after they had consolidated their hold on Inner Mongolia and Korea. The rebel emperor in Peking had only a few weeks on the Dragon Throne before he had to flee for his life. The Manchus, joined by Chinese renegades, swept on through the provinces against bitter though ineffectual opposition, the last Ming pretender being ousted in 1659. Revolts on the southern coast and interior provinces were finally crushed in 1683. About a century of peace ensued, a century characterized by a last considerable burst of native culture, supported by Manchu arms. The boundaries of empire were stretched to include the whole of eastern Asia from Hainan to Sakhalin and from Korea to the Pamirs. Commercial relations with Europe and the New World, largely through such ports as Canton, Macao, and Manila, increased and grew steadily more profitable. Population rose steeply. The minor arts were much in demand. Native thought, stimulated first by anti-Manchu feeling, and next by introductions from the West, had another impressive renaissance. The duration of this was shortened, however, by imperial disapproval and censorship. Great compilations were again published under court sponsorship; also many private works on historical criticism, mathematics, antiquities, and the like.

The Manchus continued a government much like that of the Ming, insisting, however, on the maintenance of guards of Manchus, Mongols, and Chinese loyal to the throne in key cities scattered throughout the country. Their fault lay in allowing the governmental machine to deteriorate, in refusing to recognize at the zenith of their power the growing discontent within their own borders, and the burgeoning strength

of generally despised states abroad. The suppression of tribespeople in the southwest and mishandling of Moslem adherents in the west resulted in rebellions which were intermittent after 1774. Secret societies banded the peasantry into powerful antigovernment forces. For a hundred years the Manchus had to cope with these revolts both in China Proper (to 1873) and in Central Asia (to 1878). Better led, and unimpeded by foreign support of the imperial armies, the rebels might have succeeded in driving the alien conquerors back to their homeland. It was not to be, however, until the beginning of the 20th century, after another outbreak (1899–1900) by a secret society (the Boxers)—adroitly turned in full against the foreigner—had shown the utter collapse of Manchu authority and ability to govern.

The nations of Europe made clear from the beginning of this dynasty their determination to trade and have other dealings with the people of China and their overlords. At first the interchange of goods in southern ports (with Spanish, Portuguese, Dutch, and British) and on the northern frontier (with the Russians) was fairly brisk, and the Manchu welcome to European embassies and Roman Catholic missionaries cordial. Coolness came when the court was angered at the arrogance of many Europeans and at what it took to be a slight from the Holy See. Bitterness too arose over the unwillingness of the foreign trader to be governed by imperial regulations at the ports, particularly when it was discovered that there was a flight of Chinese currency from the mainland.

A special grievance was that of opium imported on Western vessels from India and Turkey. Sale of opium was forbidden by decree in 1729, and its importation prohibited in 1796. Nevertheless, British and other vessels, including American, insisted on the right to carry it to Canton where it found a ready, if illicit, market. This conflict of wills exploded finally in a short war (1840–1842), localized in the south, won by the British, at the conclusion of which Hong Kong was ceded and 5 ports were opened to trade. (See also OPIUM TRAFFIC.) Other nations seized the opportunity to gain the same and other advantages, until within two decades 11 additional ports were opened, extraterritoriality of their nationals was granted, a maritime customs service in charge of a Westerner was created, legations were established at Peking, the importation of opium was legalized, and Catholic and Protestant churches were permitted to carry their evangel into the interior, own property, and engage Chinese to teach their people the language of the country (latterly forbidden).

The Industrial Revolution on both sides of the Atlantic was now in full swing, and it boded ill for any country whose defenses were down. In 1860, when the Manchu government blocked the ratification of the British and French treaties, duly negotiated two years earlier in Tientsin by James Bruce, 8th earl of Elgin (q.v.) and Baron J. B. L. Gros, expeditionary units of the French and British armies forced their way to the gates of Peking, and looted and set fire to the ^{palaces} palaces of the imperial family outside the city.

In the next few decades it seemed likely that China would be partitioned by the strongest powers. Areas all around the country fell away: Indochina, Burma, Formosa, and the Pesc were appropriated by France, Britain, and Ja

Russia penetrated the valley of the Ili. Japan successfully ousted Manchu troops from Korea. There was a scramble for concessions by Great Britain, Germany, Russia, and France. Sizable indemnities were exacted. Thousands of Chinese peasants were taken abroad by labor pools and underwent lives of virtual slavery despite protests from Peking.

The United States Secretary of State John Hay (q.v.), following a private British suggestion, proposed in 1899 to Great Britain, France, Germany, Russia, Italy, and Japan that China be regarded as an open market for international commerce, and that these powers, together with the United States, join in helping China regain its independence and reform its government. Even before these proposals were formulated a few high-minded Chinese, notably K'ang Yu-wei and Liang Ch'i-ch'ao, had sought out the Manchu emperor, Tsai-t'ien (reign name Kuang-hsü, 1875-1908), in the palace (1898) and persuaded him to issue a series of edicts promoting a new education, a new set of examinations for civil service appointments, an army drilled by Western methods, judicial reform, encouragement of agriculture, industry, and engineering, translation and distribution of important Occidental books, and other reforms. The people were unprepared for so drastic a change.

The empress dowager, Tz'ü Hsi (Hsiao-ch'in, regent 1862-1873, 1875-1889, 1898-1908), a shrewd and calculating woman then in retirement, who had entered the imperial household as concubine to an earlier emperor, promptly dethroned her nephew, canceled the proposed reforms, and executed the reformers or drove them from the country. The stage was set for almost anything to happen. The society of Boxers (largely effective in the north), whose original aim had been to overthrow the Manchus, provided the answer by stirring up ill feeling against the foreigner; the Imperial Army joined forces with them. In June 1900 they attacked the church centers and the legation quarter in Peking and the foreign community in Tientsin, and massacred many innocents elsewhere, mostly in north China. By the end of the summer the foreign powers had come to the rescue of the besieged and brought peace; their representatives were soon to sit down to discuss the indemnities and penalties.

The experience, costly though it was, brought the court and the people to their senses. Long overdue reforms were launched. Thousands of students went abroad, particularly to Japan, to study politics, law, engineering, medicine, and other subjects. Trade developed in volume. Foreign eleemosynary work increased. Efforts were even made to democratize the government, but they were started too late to save the Manchu. His day was done. The war between Russia and Japan (1904-1905) deprived him of Korea and Liaotung. The almost simultaneous death of the empress dowager and the emperor (1908) removed an able, if unscrupulous, woman and an ineffective idealist from the seats of power. The reformers exiled abroad and many of the students in Tokyo, Paris, and elsewhere worked unceasingly to rid the land of the alien incubus.

The Republic, 1912.—The many dissatisfactions came to a head in September 1911 over the railroad construction program in Szechwan. When many innocent people who protested against the way it was handled were wantonly killed by the soldiers of the governor general at Chengtu,

the whole province burst out in revolt. Within a month (October 10) the revolt had spread down the Yangtze River to Wuchang, another provincial capital. (The double tenth celebration dates from this event.) Province after province in south China followed suit. Many Manchu settlements were put to the sword. The recently organized National Assembly in Peking showed its spirit by demanding the resignation of Prince Regent Ch'un (Tsai-fêng). Yüan Shih-k'ai, a military officer and idol of the army, was made premier. Outer Mongolia declared its independence. Meanwhile Sun Yat-sen, chief agitator abroad for a new China, had returned to Shanghai and on Jan. 1, 1912 had been inaugurated at Nanking as president of a coalition of southern provinces. Negotiations between Yüan and the imperial family on the one hand, and between the northern and southern provinces on the other, resulted in the abdication of the Manchu house, the resignation of Sun, the inauguration of Yüan as president of China, and the retention of Peking as capital. The Chinese were at last technically masters in their own land.

Unhappily, a crisis was taking shape abroad that was to affect the world. Within a few weeks of the outbreak of World War I, Japan demanded from Germany the surrender of its property on the Shantung Peninsula, and followed up the demand with force. China protested its neutrality and asked for the removal of Japanese troops. Japan retaliated with the secret presentation to Yüan himself of a series of demands, in five groups, most of which were a serious encroachment on the sovereignty of China. This was an extraordinary affront to a nation, not at war, supposed to be independent. The secret became quickly known, the people were indignant, the United States declared to both nations that it refused to recognize any agreement affecting its own treaty rights or impairing the political and territorial integrity of the new republic, and China even made counter demands on Japan which it was powerless to enforce. Nonetheless, the republic capitulated in May 1915 to a modified set of demands. With Europe embroiled in war, and the United States unprepared to settle such a question by resort to arms, Japan used its opportunity to the utmost, even proceeding in 1917-1918 to make secret treaties with Great Britain, France, Russia, and Italy to support its own position in return for military, in particular naval, assistance. These treaties were revealed only at the peace conference at Paris.

At the same time China's domestic affairs were proceeding badly. The ambitious Yüan made no disguise of his contempt for parliamentary institutions, and tried to make himself emperor. Pamphleteers, notably Liang Ch'i-ch'ao, denounced his schemes. The southern provinces rose in insurrection. Yüan died (1916) in the effort. Although a series of men followed him as president, the country was disunited for more than a decade thereafter. Yüan had built a personal, rather than a national army. Other provincial leaders followed suit. There was a jockeying for power all over the country; in the south, southwest, west, center, east, and north. Some of the army leaders, known as war lords, were of peasant, even bandit, origin and were interested in little more than personal aggrandizement, profit, and sensual satisfaction. They taxed the people in some areas mercilessly, insisted on the planting and sale of the opium

poppy to fill their own coffers, and let justice go by the board. No wonder that communism fed on such a situation and took root in certain areas. When the Nationalist (or Kuomintang) Army, under Russian Communist guidance, overran Kwangtung and Kwangsi (1924-1926) and marched northward from Canton in 1926, it took advantage of these conditions and rapidly organized the workers. By 1928, however, the conservative faction, under Chiang Kai-shek, had won the day, and was freezing Communists out of high places in the Kuomintang. Chiang had also won as allies several of the war lords, including one in the three northeastern provinces (Manchuria), and was able to move with impunity into Peking (then renamed Peiping). Nanking was made the capital. It took, however, another decade before all the war lords were united (even superficially) under his leadership against a single enemy—Japan. The Communist faction, which he forced out of pockets in south China into the northwest, after bloody fighting, joined him in a common front for a time but was shortly alienated by repressive measures.

While China was suffering in the effort to convert its government from Manchu to Chinese, and from empire to republic, events abroad were affecting its development. In 1917, China agreed to the United States proposal to enter the war against Germany. This took China out of the area of German intrigue, cut off Germany from certain supplies, provided for the internment of German and Austrian nationals and vessels in Chinese ports, and made for some aid in the Siberian situation. Militarily China did nothing although upwards of 200,000 Chinese served in labor battalions in France under French, British, and (at the end) United States direction. Joining the war effort did mean, however, that China would have a say in the peace. Its representatives at Paris strongly opposed Japan's contention that all of Germany's rights to Shantung belonged to Japan by right of conquest, and refused to sign the Treaty of Versailles as a consequence. But China did sign the treaty of peace with Austria, and so became a member of the League of Nations.

Two years later (1921-1922) representatives of China and Japan, brought together by the United States at the Washington Conference on limitation of armaments, were able finally to agree on ways of settling the Shantung issue. Other points brought up indicated that foreign nations were prepared to consider the restoration to China of full sovereignty. In the next few years these were dealt with, namely, the withdrawal of foreign post offices, the relinquishment of wireless stations, and the restoration of tariff autonomy (1929). In the same decade too the national government likewise asserted enlarged control over the maritime customs, and regained such foreign-administered areas as Weihaiwei, and parts of Hankow, Kiukiang, Tientsin, and Amoy. In 1926 three Chinese members were included on the governing body of the International Settlement of Shanghai, and in 1928 new civil and criminal codes were put into effect. In the same year the Chinese extended their jurisdiction over the courts in Shanghai. The relinquishment of extraterritorial rights by the United States and British governments was under negotiation at the same time, but not formally put into treaty form until 1943 because of the outbreak of war with Japan in Man-

churia. Similar treaties were negotiated with other powers. China had succeeded in removing practically all limitations to its sovereignty within a generation.

Japan after acquiescing for about a decade in China's effort at control within its own borders, suddenly turned on China in 1931. What determined this shift of policy is outside the scope of this article. (See *WORLD WAR II—Japan's Pattern for Conquest*.) Suffice it to say that Manchuria was invaded and the native city of Shanghai subjected to a brutal bombardment and assault. A commission appointed by the League of Nations failed in its endeavor to halt Japanese aggression. The truce of 1933 made Japan master of Manchuria (including Jehol) and of the eastern part of Hopeh. An uneasy situation continued as the Japanese smuggled large quantities of their own goods into north China, supported an unsuccessful invasion by Mongol troops of Suiyuan, established their control over parts of Chahar, and tried to subject Chinese officials north of the Hwang Ho to their own will.

By 1937 elements in the armed services and possibly as well in the Japanese government decided that the time had come to strike a stronger blow. China's unification by then was virtually consummated, and the Communist forces had been driven out of Fukien and Kwangsi into northern Shensi and seemed even eager to accept Chiang's direction in a fight against Japan. Besides, the army had been partly modernized, several railroad lines and many motor roads had recently been completed and a few airlines established, the industrial output was increasing, and the currency had been reformed. The Chinese Republic was at the peak of its strength.

The blow fell in July when units of the Japanese Kwantung Army and Chinese forces clashed west of Peiping. For the first year, despite immense losses on the coast, from Peiping and Tientsin south, the Chinese stood up surprisingly well. Political leaders from Shantung, Yunnan, Kwangsi, and Szechwan pledged Chiang their loyalty and the Communists were enrolled in the National Army. There was wholehearted defense of one city after another. Supplies could still enter the port of Canton and utilize the railway running north to Hankow, which had become temporary capital since Nanking's capture in December. With Hankow's loss (1938) the war took a new turn. The capital was moved still farther up the Yangtze Kiang to Chungking. Lines of supply were difficult to maintain. Almost the whole of China's industrial plant, save what was transportable, had to be left behind. Until the summer of 1941, Russia shipped supplies across the Gobi, while the United States and Great Britain sent their supplies by way of Indochina. Then Japan forced Indochina to close the railway to Yunnan (1940), seized Hong Kong (December 1941), and occupied Burma (1942). The Chinese Army was back on its heels with virtually no munitions to wage a modern war.

Support from outside came slowly. By 1945, following victory over Germany, the USSR had penetrated Manchuria, and the United States Army and Navy were about ready to launch a full scale attack on the Japanese armed forces farther to the south. However, Japan capitulated before that moment came.

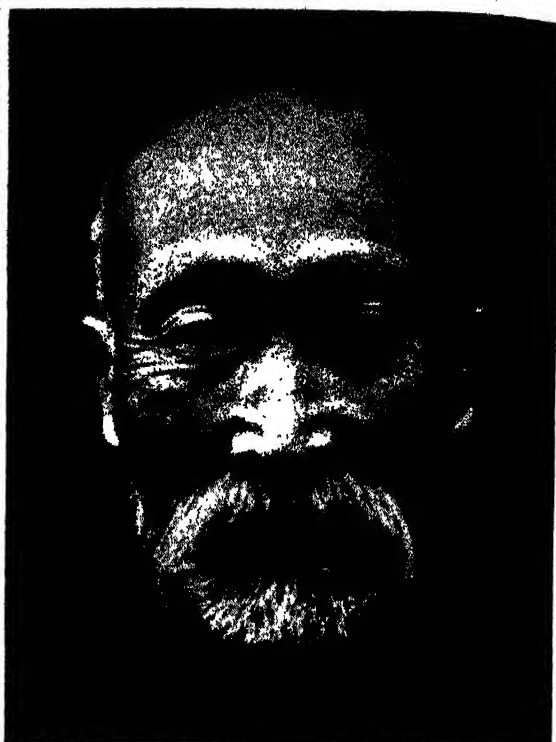
Tasks undertaken after Japan's surrender



CHINA Top: A herd of horses on an Inner Mongolian plain. In the background are pitched the yurtas, or moveable tents, of Mongol herdsmen. Right: Sail hoisted high, a lake boat enters the canal leading into Kunming. Lower center: Yenon in Shensi Province, until early 1949 the capital of the Chinese Communists. Here offices, factories, hospitals, and homes were established in hillside caves for protection against air attacks. Bottom: Swirling pattern of rice paddies along the Chungking-Chengtu highway.

(Top, bottom) Triangle Photo Service; (others) Gullumette (CNS)





(Top right) Paul Guillumette, Inc. (CNS), New York; (top left) Philip Gendreau
New York; (others) Triangle Photo Service, New York

Top left: Chinese artist and educator. Top right: An old bearded native of Shanghai. Bottom left: Costumed bride
Inner Mongolia. Right: An Inner Mongolian chieftain of minor rank.

included the disarming and repatriation of Japanese nationals, recovery of interior and coastal points long held by the enemy (Nanking became the capital once more), and arrangement with the USSR to reassume control over Manchuria. The last, in spite of promises by the Soviet government, could not be effected as long as the Nationalists were in power; only in February 1950 was a working agreement reached on this head between the new People's Republic of China and the USSR. Throughout the last months of 1945 and the whole of 1946 an attempt was made, largely under United States leadership, to restore the Communist-Kuomintang entente, so near rupture during the last half of the war. Gen. George C. Marshall, after prolonged effort, returned from Nanking to Washington in January 1947, sharply criticizing both the Communists and the reactionaries in the Nationalist government, and declaring that China's hope lay in "the assumption of leadership by the liberals in the government and in the minority parties" under the guidance of Chiang Kai-shek. This report ended all hope that peace might develop. Only civil war, it was clear, and the collapse of one side or the other, would bring unity.

Inflation, economic difficulties, shortages of many basic materials, limited transportation facilities, and misgovernment in places both high and low brought the Nationalists into low repute. Their armies succumbed to the Communists rapidly toward the end of 1948, sometimes without a fight, and by the end of 1949 were wearing the uniform of the victors or were in flight to border lands or to the islands of Hainan and Formosa. On Oct. 1, 1949, the Communists formally declared Peking (which resumed its old name) their capital and constituted their government as the People's Republic with Mao Tse-tung at the head and Chou En-lai as premier and foreign minister. By early 1950 the USSR, Great Britain, India, and other nations granted it recognition, although the officials representing China at the United Nations were still those appointed by the Nationalists. Meanwhile, Chiang Kai-shek and a considerable number of his supporters, both civil and military, remained ensconced in Formosa and refused to admit defeat. With a considerable supply of ships, airplanes, and modern armament they harassed China's coast, blockaded the ports, and bombed industrial and shipping centers from Canton to Tsingtao and threatened Tientsin and Hankow as well. These acts caused serious damage and made the new government's efforts toward physical recovery and economic stability difficult. On June 27, 1950, this situation changed when, after the outbreak of the Korean war, President Harry S. Truman requested the Nationalist government to cease its attacks and ordered the United States Seventh Fleet to patrol Formosa Strait to protect the island.

There have been many positive gains for China in the years since 1912, although war has destroyed or postponed some of them. The binding of women's feet has virtually disappeared, and women have won new independence outside as well as inside the home. Labor, always held in theoretical respect, but more often despised and maltreated in practice, is making a better place for itself. The queue, worn by men as a badge of servitude to the Manchus, disappeared. Government and private agencies have bestirred themselves in education, at

an ever-increasing tempo, until both men and women have been able to get a primary, secondary, and college education without leaving the land. In some fields, such as medicine, agriculture, business, law, engineering, and theology, it was even possible before 1937 to get satisfactory technical training in a few cities. The country was not ready, however, for compulsory education, and illiteracy was and is a major problem.

The written language, its usefulness for common intercourse at an end, was largely displaced by the vulgate, and many writings and textbooks appeared in the new medium. Publishing houses, with a large volume of business in all kinds of books, mushroomed in the port cities. Libraries, stocked both in the new learning and the old, flourished. Newspapers and journals, many of them fly-by-night and insubstantial, became very numerous; a few of them were serious molders of opinion or made contributions to literature and scholarship. Institutes of research, both in modern science—such as geology and medicine—and in antiquities—such as history and archaeology—were fostered by students returned from abroad, locally trained scholars, and foreign subvention. Commerce and banking on modern lines were widely introduced. Agriculture, mining, and industrial methods were improved, new seeds and livestock introduced; and a widespread effort to teach the masses the elements of reading and writing, sanitation, economics, and democracy began.

Many precious things of brick and marble, paper and silk, porcelain, jade, and bronze were destroyed by the Japanese during the war. For a short period thereafter there was evidence of an effort to reinitiate work in the ancient crafts, but the leaders of the new government put an end to them, encouraging instead basic industries, rural cooperation, and improved farming. They were concerned too with public health and removal of the causes of poverty, but the task of meeting the demands of the day were so insistent, the number of mouths to feed so many, and the tools and funds to work with so limited, that the reforms they hoped for might take a long time to carry out.

By 1950 a different China was emerging, with Communist leadership firmly in control of the country. Most of its domestic problems remained the same: how to develop a sufficient food supply; how to eliminate pestilence and lower both the birth and mortality rates; how to control the river systems and if possible turn them into instruments of power; how to exploit the natural resources for the general benefit; how to develop industry and communications; how to reduce illiteracy and provide genuine educational advantages for the worthy. In foreign relations its policy was closely knit with that of the Soviet Union, and its expansionist movements were bringing the world to the brink of a general war. In late October one army invaded Tibet against the sharp protests of the Indian government; in mid-November a far more massive force struck across the Yalu River and forced the almost victorious Republic of Korea and United Nations armies to give up their hard-won gains north of the 38th parallel; a third stood poised in the south, ready to aid their political allies in Indochina. A delegation sent from Peking at the end of November upheld its government's actions before the United Nations

and accused the United States for its actions in Korea and with respect to Formosa.

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L. CARRINGTON GOODRICH,
Professor of Chinese, Columbia University.

2. LANGUAGE. Chinese is one of the major languages of the world, spoken by approximately 450,000,000 people. It is the chief member of the Indo-Chinese family of languages, which also includes languages of the Thai branch, such as Siamese, as well as those of the Tibeto-Burman subfamily. The genetic relationship of Chinese to the Tibeto-Burman languages, however, has not been absolutely established. Although both Japanese and Korean contain many borrowed Chinese words, Chinese is not related to either of these languages.

Word Formation.—Chinese is often described as a monosyllabic language, but the validity of this statement depends upon what we regard as a word in Chinese. The language has two types of units, each of which has some, but not all, of the features of a word in other languages. The first type is the monosyllable, called in Chinese *tsü*, which almost always operates as a meaningful unit. Partly because the *tsü* is written with a single character, it is frequently mentioned in everyday speech. People talk about learning *tsü*, using the right or wrong *tsü*, paying so much for 10 *tsü* in a telegram, or receiving so much money per 1,000 *tsü* for contributing to a periodical. The second type is the syntactical unit. It can be spoken independently and combined with a high degree of freedom, and therefore acts more like a word in the linguistic sense. It may consist of a single *tsü* or of a close-knit combination of two or more *tsü*. In short, we can say that the Chinese language is monosyllabic or polysyllabic, depending upon whether we base our definition on the single root word or on the syntactical unit. In this article we shall speak of words in either sense, but we shall distinguish when necessary between root words and syntactical words.

The Chinese syllable has a rather simple phonetic structure. Except for a few words that

begin with vowels, each syllable begins with a consonant or a consonant cluster. The cluster is usually simple, consisting at most of a stop, a fricative, a spirant, and a semivowel: for example, *ts'u* (*ts'w-*) in *ts'uan*. There are no words of the *str-* or *spl-* type. Then there is a main vowel, with or without a final consonant or semivowel. In most parts of China there are only two semivowel endings, *-i* and *-u* (forming diphthongs like *ai* and *ou*), and three consonant endings, *-n*, *-ng*, and *-r*. In ancient times there were other endings—for example, *-m*, *-p*, *-t*, *-k*, *-b*, *-d*, and *-g*—but these have largely disappeared, although a few persist in the dialects of the southeast.

In addition to consonants and vowels, there is a third constituent element of the Chinese word. This is the height and movement of the fundamental pitch of the voice, known as tone. Tones have often been described as a device to distinguish words. This is true only in the sense that differentiation between vowel sounds is a device to distinguish the English word "met" from "mat," and differentiation between consonants is a device to distinguish "mat" from "mad." Actually, of course, the tones in Chinese have evolved from unpremeditated natural causes. The sounds of the four tones in Mandarin, or Standard Chinese, are (1) high level, (2) high rising, (3) low rising (or low dipping) and (4) high falling to low. Occasionally, words differing only in tone are etymologically related—for example, *hao*³ (good) and *hao*⁴ (fond of), which are related in somewhat the same way as "man" is related to "men." But the majority of words which differ only in tone are quite unrelated—*fei*¹ (fly); *fei*² (fat); *fei*³ (bandit); *fei*⁴ (waste, spend)—as in the case of "mat" and "met." In most parts of China there are four tones. The same words are usually grouped in the same class, but the pitch pattern of each class varies sharply from one locality to another.

Grammar.—Most Chinese sentences have a subject and a predicate, although minor sentences, corresponding to such expressions as "What a nuisance!" and "Never heard of such a thing," are less unusual in Chinese than in English. The subject in Chinese is literally the subject matter and need not represent the agent performing the action. For example, *cher yao k'ai p'u-tzü*, which is translated "They will open a store here," means literally "This place will open store," or more analytically, "As for this place, there will be opened a store." Within either the subject or the predicate the words are arranged in four main types of construction: (1) coordinate construction, often without conjunctions or even pauses, as in the expression *tung nan hsi pei* (east, south, west, and north); (2) qualifier-qualified construction, with the parts always in that order, as in *huai jên* (bad men) *hên k'uai tē p'ao* (very quick-ly run—run very quickly), or *kang tsou tē jên tē mao-tzü* (just left kind of man's hat—the hat of the man who has just left); (3) verb-object construction: *hsieh hsin* (write letters) or *wên t'a chao shei* (ask him look-for who—ask him whom he is looking for); and (4) verb-complement construction—*sao-kan-ching t'a* (sweep-clean it—sweep it clean) or *ta-p'o* (strike-broke—smashed).

The parts of speech in Chinese are similar in many respects to those in English, but there are two important differences. First, words denoting qualities do not have special grammatical

features of their own but behave like other intransitive verbs: *t'iar hao* (weather fine—the weather is fine). Secondly, there is a class of particles or enclitics which are attached to words or to sentences to express moods or aspects. In addition, there is considerable overlapping of function among Chinese words, just as in English the word “cut” can be used as a noun, a verb, or an adjective. The common belief that Chinese has no parts of speech is a gross exaggeration. Most words have only limited functions: *chih* (paper) is always a noun; *t'i* (kick), always a transitive verb; *tsao* (early), always an adverb or quality verb.

While the above sketch gives the main structural features of the Chinese language, it will be of interest to the general reader as well as the practical student to see how the formal features of an Occidental language like English would be translated into Chinese. In the first place, an English word corresponds in translation much more closely to the syntactical word in Chinese than to the monosyllabic root word: *ti-pan* (ground-board—floor), *huo-ch'ê* (fire-vehicle—train), *hsien-tsai* (appear-exist—now), *t'u-shu-kuan* (charts-books-institution—library). Chinese nouns are not distinguished by number, the notion of number being expressed, when necessary, by numerals or by words like “many” or “several.” There are no articles, but most nouns designating individual persons or things have specific numeratives or classifiers which must be attached to a preceding numeral or demonstrative: for example, *i-t'ou nu* (one head of cattle); *ch'ei-ko jên* (this piece man). Definiteness and indefiniteness are expressed by specific words, and there is a strong tendency to place words of definite references in the subject position and words of indefinite reference in the object position. *Shu hai mei k'an* means “The book has not yet been read,” but *hai mei k'an shu* means “(One) has not yet read (any) book.” Personal pronouns have no case or gender, *t'a* meaning “he,” “him,” “she,” “her,” or “it.” There are a few prepositions, such as the semilitary *yü* (at), but most spatial and temporal relations are expressed by substantive root words of location: *li yu ren* (room-inside has people—there are people in the room); *shan-shang tê shui* (hilltop's water—water on the hill).

Chinese verbs have neither tense nor voice, and notions of time or received action are expressed, when necessary, by adverbs or other explicit means. Complete action or change of state, whether in the past, present, or future, is expressed by the particle *lê*. Progressive action is expressed by the particle *chih* or *chê* (-ing), the adverb *chêng tsai* (right at), or the final particle *nê*. The verb *shih* (to be), is normally used before predicate nouns, as in the expression *wo shih jên* (I am a man), but it is not used before adjectives, since these are themselves verbs. Because the qualifier always precedes the qualified word, an adverbial clause always precedes the main clause, as in *yao-shih ni lai, wo chiu lai* (If you come, I then come—I shall come if you do).

Historical Development.—The preceding description covers the principal features of the Chinese language. In a country as large as China, however, there are many dialectal variations, and there have also been changes through the centuries. This is especially true of sound, less so of vocabulary (the use of words out of the stock of root words), least of all of grammatical structure.

In the period represented by Confucius (c.551–479 B.C.), the Chinese language possessed a rather rich system of consonants and vowels, and probably only three tones. There were four grades of initial consonants (for example, *p*, *p'*, *b*, *b'*, like the Sanskrit *p*, *ph*, *d*, *dh*) and a variety of consonant endings (*-m*, *-n*, *-ng*, *-p*, *-t*, *-k*, *-b*, *-d*, *-g*, *-r*), but no final semivowel. There were also occasional consonant clusters like *kl-* and *pl-*. Later, as we learn from a dictionary published in 601 A.D., and other sources, the four grades of consonants were reduced to three: *p*, *p'*, and *b'*. The final consonants *-b*, *-d*, *-g*, and *-r* were dropped, and final semivowels appeared, to form diphthongs with the main vowel. The number of tones increased to four. In the majority of the modern Chinese dialects there are usually only two grades of consonants (*p* and *p'*) and, as we have noted, three consonant endings (*-n*, *-ng*, and *-r*). The four tones of modern Chinese differ from those of ancient Chinese in that the old first tone has been subdivided into the modern first and second tones and the old fourth-tone words have been distributed among the other modern tones.

The monosyllables functioned more independently as words in ancient Chinese than they have in the language at later stages. Moreover, there are in the old texts traces of inflection, as in the use of *ngo* for “I” and *ngâ* for “me.” The cognate modern words, *wu* and *wo*, have no such distinction. In general, however, there has been remarkably little structural change in the Chinese language.

The chief dialects into which ancient Chinese has developed may be classified into nine groups: Cantonese, Kan-Hakka, Amoy-Swatow, Foochow, Wu (Kiangsu-Chekiang region), Hsiang (Hunan Province), and Northern, Southern, and South-western Mandarin. The first six groups, which are concentrated in the five or six provinces on or near the southeast coast, have preserved more features of the ancient pronunciation than the others. The last three groups, which cover three fourths of the area of China proper and two thirds of the entire population, are characterized by relative uniformity of pronunciation and vocabulary. For this reason, it is possible for a resident of Peking (Harbin), Manchuria, to understand a resident of Künming, Yunnan Province, without too much difficulty. Standard Chinese, variously called Mandarin or *kuo-yü* (national language), belongs to the Northern Mandarin group, and its standard of pronunciation is that of Peking.

A development of great cultural significance in the history of Chinese has been the growth of a literary language along with the spoken language. We have evidence that at least as early as the 9th century A.D., there were two divergent idioms, one quite similar to present day Mandarin, and the other like the writing of previous centuries. Through the centuries the spoken language, which was rarely written, changed more and more in pronunciation and vocabulary, whereas the written language, because all literate Chinese read a common body of literature, remained almost uniform. Such changes as have occurred in the written language have taken place throughout the country, that is, uniformly with respect to diction and composition, though not with respect to pronunciation. Hence every educated Chinese has one system of pronunciation, that of his present local dialect, whether Man-

darin or one of the other groups, but two idioms, his local spoken idiom and the literary idiom common to the whole country. The literary idiom does not merely exist on paper, but is learned through reading aloud, and the Chinese read and compose aloud or *sotto voce* to a greater extent than other peoples. Although literary Chinese is never spoken, it is an actual language or idiom (quite apart from the fact that there is a uniform system of writing for all the variant pronunciations).

In 1917, Hu Shih (1891—) and other scholars initiated a movement to have Chinese written in the spoken idiom rather than in the literary idiom. There already existed a small body of Mandarin literature, mostly in the form of novels. The movement was encouraged by the educational authorities, who ordered that the school curriculum through the sixth grade be taught in the spoken style of Mandarin, called *pai-hua* (plain talk). This step had two purposes. In the first place, it would be possible for two thirds of the country's children, those from the Mandarin-speaking provinces, to read and write in a close approximation to their mother tongue rather than in an additional literary idiom. Secondly, the remaining one third would learn the standard dialect, thereby helping to unify the spoken language. While the *pai-hua* movement made relatively slow progress from a quantitative point of view, by the 1930's it had succeeded in establishing the prestige of the spoken idiom. It had been most successful in literature and science, less so in the fields of business and government.

Writing.—The Chinese system of writing consists of characters representing the *tsü* or monosyllabic root words. Speech elements smaller than a syllable do not normally correspond to elements in the characters. According to the traditional system of classification, there are six categories of characters: pictographs, simple ideographs, compound ideographs, phonetic loans, phonetic compounds, and derivative characters. Examples of the first five categories are: (1) 山 (*shan*, mountain); (2) 二 (*êrh*, two); (3) 明 (*ming*, bright), consisting of the characters for "sun" and "moon"; (4) 無 (*wu*, have not), a pictograph for a word with the same sound meaning "dance," it being impossible to picture the idea of "have not"; and (5) 柿 (*shih*, persimmon), consisting of a significant part, 木 (tree), and a phonetic part, 市 (*shih*, market). The sixth class contains few members and is not important.

Although the characters have changed comparatively little in 2,000 years, the pronunciation of the language has altered considerably. When a modern Chinese reads a passage of Confucius or Lao-tzu, he reads words of his own present day dialect which are cognate with the words of the ancient language. Because the phonetic changes from ancient to modern Chinese have not always been parallel and regular, the phonetic parts of the phonetic compounds—a majority of all characters—do not always indicate the modern pronunciation of the compounded characters and in practice have to be learned individually.

There is only a rough correspondence between the spoken word and the written character. Because of the process of phonetic loans mentioned

above, a character often represents words which have the same sound but different meanings. For example, the character 未 represents two words: *wei* (not yet) and *wei* (the first double hour after noon). A much more important divergence between word and character has taken place because the number of characters has been increased to indicate extensions of meaning of what is linguistically the same word. Thus the word *yüan*, meaning "primary," "original," or "source," for which a single character, 元, was used in the ancient texts, has come to be written with three different characters—元, 原, and 源—for its three meanings. In this way, the number of characters used for most words in Chinese has multiplied to several times the number of the words. In a large dictionary there are about 40,000 or 50,000 characters, and the telegraph code book contains nearly 10,000. One kind of Chinese typewriter has 5,400; a list of characters for use in the first four grades of school has 2,741; and the basic list of Yen Yang-chu (James Y. C. Yen, 1894—) has 1,200. The number of root words in the speech of an illiterate adult is estimated at 2,500 to 3,000 *tsü*.

Characters are arranged in dictionaries according to sound or form. The oldest dictionaries grouped characters according to tones, rhymes (vowel and ending), and initial consonants, so that all characters with the same sound appeared under the same heading. Modern dictionaries which arrange characters by sound reverse the order: initials, finals, tone. A more frequently used system is the arrangement of the characters according to the 214 radicals or recurrent parts. These correspond roughly to the significant parts of phonetic compounds. The radicals are arranged in ascending order of number of strokes, and the characters under each of the radicals are arranged in ascending order of the number of the remaining strokes. In addition, a system of arrangement based on the four corners of the characters is often used in library catalogues.

Since it is difficult to learn large numbers of characters, various schemes of writing reform have been proposed and tested on a limited scale. In 1919 the Ministry of Education promulgated a set of 39 national phonetic letters (later revised to 40, then to 37) as an aid to the unification of the national language. Occidental missionaries have tried to use these letters as a system of phonetic writing. In 1928 the Chinese government adopted a system of national romanization as an alternative to the phonetic letters. Various technical and cultural difficulties, however, stand in the way of an alphabetic system of writing. Since the concise literary idiom based on the language of past ages, when there was a rich variety of sounds, is no longer completely intelligible to the ear when read with a modern pronunciation (as it always is), it is not intelligible to the eye when written with the modern Mandarin pronunciation. The use of an alphabetic system must therefore be limited to writing the spoken idiom. The adoption of such a system, its opponents argue, means a break with the past, as represented in the literary idiom. They also fear that if people wrote their dialects alphabetically, the unity of the written language would be destroyed. Those who favor alphabetic writing contend that its adoption would further

the vernacular literary movement and help to spread the knowledge of standard Mandarin.

Romanization and Pronunciation.—During and after World War II there was a marked increase of interest in the Chinese language among English-speaking peoples. Methods of teaching based on modern linguistic research have made the problem of learning to speak Chinese fluently a matter of one or two years, instead of five or ten. For the general reader who does not intend to learn the language, a knowledge at least of the Wade-Giles system of romanization, commonly employed in books written in English on Chinese subjects, is desirable. The English equivalents of the Chinese sounds of the letters in the Wade-Giles system of romanization are as follows:

a	father	i	police
ai	aisle	ih	vocalized
au	out		r
h(i), ch(ü)	jeer	k	goat
h(ih), ch(other vowels)		k'	coat
h'(i), ch'(ü)	dry	p	beak
h'(ih), ch'	cheer	p'	peak
(other vowels)	try	t	deem
ɛ	up, long-thened	t'	team
h	oh yeah	ts, tz	Windsor
i	eight	ts', tz'	it's hot
erh	err, Middle Western	u	rule
hs	she; German ich	u	French usine
		ü	buzz
			Other letters as in English

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Y. R. CHAO,
Professor of Oriental Languages and Linguistics,
University of California.

3. LITERATURE. In dealing briefly with a literature that extends back to approximately the 15th century B.C., our main concern will be with belles-lettres. Yet works of history, philosophy, allegory, and aphorism, especially of the early periods, are so closely woven into the roots of all later literature that they must be given due attention.

The conventional division of Chinese literature into four departments—canons, history, philosophy, and miscellany—is merely an outdated library science without direct bearing on our discussion. More relevant are the following age-old characteristics:

(1) Although in most dynasties the court was the center of literary fashion, folk creation was the important life-giving force of literary innovations. Foreign influence on poetry and fiction often took roots first in folk songs or folklore.

(2) The ancient Chinese had a rich mythology, but left no full-fledged epic poetry to portray its heroes and gods. Rather, they became idealized men of worldly moral deeds, celebrated in didactic prose.

(3) Pacifist spirit predominates. The Chinese word for literature, *wên*, is the exact antonym of militarism, *wu*.

(4) Romantic otherworldliness, passionate

pursuit of love, and tragic conflicts of will and fate are seldom carried far. Spirituality develops in the physical world and pervades it. Hence, faithful representation of simple mundane experiences and spontaneous expression of intuitively grasped natural beauty gain breadth and depth of meaning.

(5) The peculiar qualities of the Chinese language—the logographic writing and the determination of word meaning by exact tonal modulations—ally the literature closely with the fine arts and music. In poetry the monosyllabic written characters make it easy to achieve extremely neat patterns of meter and rhyme; and prose, in the classical style at least, often rises to the level of poetry. See also section on *Language*.

The Classical Age (c. 15th to 3d Centuries B.C.).—The earliest authenticated writings of the classical period of Chinese literature are inscriptions on bronze vessels and oracle bones, the most ancient of which date from about the 15th century B.C., during the Shang dynasty. They are remarkable for their calligraphy, simplicity, symbolism of intense religious devotion, accurate recording of dates and events, and occasional solemnly sonorous rhymes. The first real flowering of Chinese poetry is found in the *Book of Odes* (*Shih Ching*), produced between the 10th and 7th centuries B.C. Extant in the book are 305 poems—lyrical, ritual, satirical, and narrative—largely of folk creation, and closely associated with music. The poems are spontaneous, vivid, and realistic expressions of social life and customs. Metrical schemes vary, but tend to follow the four-word line, with frequent rhymes. These poems enchant us with word music from the hearts and souls of a people singing millenniums ago of their love, courtship, reverence, worship, despair, lamentations about bad times, and protests against tyranny and war. They ever remain living embodiments of natural objects lighted by vivified senses of man at poetry's dawn.

Four other works, chiefly products of the classical age, are grouped with it in a collection called the Five Canons or Classics. The *Book of Change* (*I Ching*) consists of a set of symbols and texts for divination, perhaps first formulated about the 11th century B.C., with later commentaries. It presents in abstract form the original Chinese conception of the dual forces which set the universe in motion. The *Book of Historical Documents* (*Shang Shu*), sometimes called the *Book of History* (*Shu Ching*), consists of decrees, counsels, and admonitions of ancient kings, princes, and ministers, and other semilegendary records, attributed to a period from the dawn of history to about the 7th century B.C. In solemn, didactic prose, it portrays the thought and action of great ancient Chinese, who, it was said, having struggled with nature and learned its secrets, set moral standards by personal example, formed benevolent governments, vindicated the people against tyrants, and so became prototypes of the ideal sage to inspire the philosophical and literary mind of later ages. The *Spring and Autumn Annals* (*Ch'un Ch'iu*), brief records of current events from 722 to 481 B.C., because of the meticulous choice of "correct terms" in their definitions, have influenced historiography and historicoliterary criticism. Finally, some ancient ritual codes and principles of government compiled about the 2d century B.C., together with a number of Confucian dissertations, constitute the

Book of Rites (Li Chi). The Five Canons, despite misinterpretations, interpolations, and forgeries, reveal the primary forms of ancient Chinese literature and mark the beginnings of the Chinese literary tradition.

Between the 6th and 5th centuries B.C., Chinese literature entered a new stage of development, marked by increasingly elaborate description, interesting anecdotes, suggestive observation, and illuminating critiques. Of the numerous schools of philosophy which emerged during this period, two, the Confucian and the Taoist, became leading sources of spiritual guidance for later generations. To the Confucianist, man's life on earth is all important, even the world of the dead being somehow an extension of this one. Heaven and earth, the original parents of all human kind, are benevolent. Man can achieve the supreme good through aspiring toward perfecting pragmatic virtues in human relationships. The Confucianist, while acquiescing in man's fate as directed by some invisible power, seeks not to know the nature of that power beyond this world. Man's highest standard is set in humanity itself, symbolized by the ideal human sage, the perfection of the best of human nature. Much of Confucian-influenced Chinese literature is enlivened by a humanistic this-worldliness, and the most creative Chinese writers claim kinship with the classical tradition.

Confucius (c. 551–479 B.C.) himself is believed to have written little. Even the traditional claim that he edited some of the Canons is now questioned. We are certain only that his aphorisms and short discourses were recorded by his disciples in the *Analects (Lun-yü)*. Two dissertations by his followers—*The Great Learning (Ta-hsiieh)* and the *Doctrine of the Mean (Chung-yung)*—expound his philosophy in a better organized form.

The Taoist school, supposedly founded by the philosopher Lao-tzu (-tse, c.604–531 B.C.), represents a reaction against Confucianism. The canon of this school, *The Canon of the Way and of Virtue (Tao-tê ching)*, shows that it emerged no earlier than the late 5th century B.C. According to Taoist thought, there is above the physical universe a higher power, the way or *tao*. It is not a personified god, but a transcendental force above all existence and nonexistence—the absolute—which is manifest in the perfect natural state of things, the highest which man may hope to attain—the supreme good. To the Taoist all discriminations are artificial; all commonly accepted virtues pre-suppose prevalent evils. "Not until the Sage is forever dead can the Bandit be completely put out. . . ." Strong and pervasive Taoistic influence on Chinese literature has nurtured the spirit of freedom from all conventions, developing the poet's faculty for self-abandonment and keen insight into nature.

Among the philosophers of the two leading schools, Mencius (372?–?289 B.C.), the Confucian protagonist, left behind eloquent passages of oratory, and Chuang-tzu (-chou, fl. 4th to 3d centuries B.C.) wrote unsurpassed Taoist allegorical essays which form an inexhaustible source of subtle metaphor and simile. Other philosophic schools of the period—the Moists, or followers of Mo Ti (fl. 5th–4th centuries B.C.), who preached universal love, the Legalists, and the Logicians—were later overshadowed by the two great schools or lost in practical politics.

As the classical age drew to a close amid

incessant wars, sensitive men felt a keen *Weltschmerz*. Late in the 4th century B.C. appeared richly imaginative and colorful works of pure sentiment by poets of great individuality, who cultivated their art consciously through the best use of words, independent of music. Most of this new poetry was written in the Yangtze River area, the picturesque southern region of abundant flora, fantastic landscape, and emotionalism. The earliest works of this type are attributed to Ch'ü Yüan (c.343–?289 B.C.), once a minister and then an exile of the Ch'u state. His chief follower and imitator was Sung Yü (296–?240 B.C.), also of Ch'u: hence the name Ch'u rhapsody or elegy (*Ch'u tz'ü*) is applied to this style. A lengthy prose-verse mixture, with interwoven dramatic dialogue, fanciful narratives and descriptions, and soaring lyrics, it has maintained lasting influence on later imaginative literature. Sung Yü and the northern philosopher Hsün-tse (c.300–235 B.C.) also called their writings after this style *fu* (exhibitory essay), which was to develop into a very important genre in the Han age.

The Middle Epoch (2d Century B.C.–7th Century A.D.).—At the beginning of this literary period, which coincides with the major part of the Chinese medieval period, the country entered an era of national consolidation, expansion, and prosperity. The short-lived Ch'in dynasty had unified China and laid the foundations for the enormous development of the Han empire. The flourishing literature of the Han dynasty combined court refinement with robust folk elements. Its growth was nourished and stimulated through foreign contacts—with the Hsiung-nu in the north, the Tungus in the northeast, the Pacific coastal and island tribes, and the countries of central Asia. Foreign melodies and musical instruments were introduced, and exotic customs and landscapes were portrayed and discussed with growing inspiration. Now the *fu*, as court literature reflecting the new vision and material splendor of the age, unfolded at its best a panorama of rich colors and gorgeous imagery. Its greatest master was Ssü-ma Hsiang-ju (179–117 B.C.). Other distinguished writers of the *fu* were Mei Shêng (d. 140 B.C.), Yang Hsiung (53 B.C.–18 A.D.), Pan Ku (32–92 A.D.), and Chang Heng (78–139 A.D.).

As the *fu* developed, creativeness gradually gave way to stereotyped floridity. Not until the 11th century, the age of great prose, did this form, liberated from slavish imitation and artificial metrical restrictions, become a lucid but impassioned prose poem. Yet beginning with the Earlier Han dynasty lyric and narrative poetry derived directly from folk literature developed with fresh vigor. Many works of this type, often anonymous, are great poetry, comparable in directness, spontaneity, and profundity to the *Book of Odes*. Collected, edited, and sung in the Imperial Conservatory, they were soon recognized as an influential poetic genre, called the Imperial Conservatory or *yüeh-fu* style. Their metrical schemes were at first as varied as the musical forms of the age, but later a tendency toward regularity gradually emerged. Out of a sound pattern with five characters to a line came the *ku shih* (old-style poetry).

Although both folk and more sophisticated works in the Imperial Conservatory tradition flourished in earlier Han times, most of those still extant date from Later Han dynasty. Most re-

markable of the anonymous works are the *Nineteen Old Poems* and *The Wife of a Prefect Clerk*, a narrative poem of 1,800 words in 360 lines. The latter tells the story of the devoted love of a husband and wife, frustrated by a domineering mother, and ending in tragedy. Among the many authors were the poetess Pan Chao and the poet Fu Yi (both of the 1st century A.D.), Chang Heng, and Ts'ai Yung (133-192 A.D.). Much of Han poetry was tinged with Confucian moralism or Taoist mysticism, but it excelled in the objective description of social life and customs and in a deep understanding of the sorrows and joys of humble people. The love poems dealt more often with man-and-wife relationships than with intrigue or romantic courtship. In general, Han poetry represents the healthy growth of the Chinese people and of their old, stable society.

While literary forms like the *fu*, the *yüeh-fu*, and the *ku shih* grew so luxuriantly that belles-lettres began to form a major category of their own and individual genius shone more brilliantly in this field than ever before, we should not fail to mention the writings of the great Han historian, Ssü-ma Ch'ien (145-?87 B.C.). In the classical age history had consisted of the fragmentary record of events or of a mixture of anecdote, oratorical harangue, and short didactic discourse. Now, with Ssü-ma Ch'ien's *Historical Memoirs* (*Shih Chi*), it developed into lucid, systematic narrative. The traditional anecdotes were objectively examined, and historic figures became living personalities. In his masterly prose, Ssü-ma Ch'ien depicts representatives of the lower social strata as well as kings and emperors. The *Historical Memoirs* have been handed down as the first comprehensive Chinese history and the prototype of subsequent biography. Ssü-ma Ch'ien's follower and imitator, Pan Ku, in his *The History of the Former Han Dynasty*, set an example for later dynastic historians with his erudition and thorough treatment of all cultural subjects.

Three other aspects of Han intellectual life have had a lasting influence on Chinese literature:

(1) The rediscovery in fragmentary form of ancient canons, lost in wars and destruction, engaged many scholars in the tasks of philological research and textual reconstruction. Excellent results were obtained in such works as the *Etymological Dictionary* (*Shuo-wên*) of Hsü Shên (d. c.120 A.D.), and the *Survey of Dialects* (*Fang-yen*), attributed to Yang Hsiung. But fabrications and distortions of the ancient texts, largely by Liu Hsin (50 B.C.?-23 A.D.) and his contemporaries, perpetuated many misconceptions and superstitions about ancient China.

(2) The elevation of Confucianism to the rank of a state philosophy marked the beginning of its manipulation by the rulers of successive dynasties, who evolved dogmatic orthodoxies from it to suit their purposes, obscuring its humanistic philosophy with religious mysticism.

(3) Indian Buddhism began to compete with Taoism in popularity, giving rise to many superstitious cults and enriching Chinese folklore. Such Indian ideas as cycles in future worlds and nirvana, introduced in Later Han, were not as yet thoroughly digested. Mythical thinking and fanatic faith prevailed in influential circles. The crisis in philosophic thinking provoked Wang Ch'ung (27-97 A.D.) to write his *Animadver-*

sions (*Lun Hêng*), in which he analyzed and evaluated the spirit of the age. Championing literary creativeness and vigorously attacking bigotry and pedantry, he produced one of the most important contributions to Chinese philosophical and literary criticism.

With the decline of the Han dynasty, the second literary cycle began to wane. Nevertheless, the strife-torn times were brightened by a flash of literary creation. The leading figures were Ts'ao Chih (192-232 A.D.) and the Seven Greats of the Chien-an period (196-220), and Emperor Wei Wên Ti (Ts'ao P'ei, r. 220-226), first of the Wei dynasty, the first successful experimenter with a new poetic pattern of seven characters to a line. In this brief but memorable period all the literary forms popular since the Earlier Han dynasty reached new heights. Its writings were individual and tender, rich in true feeling and vigorous expression. Some of them, voicing the spirit of the age, show emotional depth and spiritual exaltation. The Wei dynasty (220-265 A.D.), one of the Three Kingdoms, was supplanted by the Tsin (Chin, 265-420 A.D.), which in the year 317 was pressed southward by barbarian tribes. In its new southern center at Chienkang (near modern Nanking), the capital of the defunct Wu dynasty (222-280 A.D.), the Tsin and four succeeding dynasties maintained a precarious existence under constant threats from the north. Here in the Yangtze Valley, through the Six Dynasties period, ending in 589 A.D., a picturesque, fanciful, sentimental, and highly artificial literature developed, stamping with its characteristic decadence the decline of a literary cycle.

Contemporaneously, north China, occupied by barbarian tribes, produced fairly little creative literature. Yet there were some charming folk verses, and the warlike spirit of the nomadic peoples occasionally burst into heroic song. The northern landscape, seen afresh under foreign rule, was sometimes depicted with barbaric beauty, sometimes with deep melancholy. These sporadic writings enriched Chinese literature.

In the south, the efforts of the literati to achieve painstakingly cultivated workmanship and mature literary criticism prepared the way for the Chinese literary renaissance. In both prose and poetry there was an extreme development of line-for-line and word-for-word parallelism. The parallel prose (*p'ien wên*) is unique, with virtues and vices of which only the Chinese language is capable. The standardization of the four tones of the language, which contributed much to later formalism, must also be credited to the early part of this period. Great literary craftsmen wrote valuable treatises on the art of writing, such as the *Essay on Literature* (*Wên Fu*) by Lu Chi (261-303). Hsiao T'ung (501-531) made the first comprehensive anthology of Chinese creative literature, *Literary Selections* (*Wên-hsiian*), in which he meticulously classified 38 separate forms and further subdivisions. And against the background of an artificial age, the critic Liu Hsieh (fl. late 5th-early 6th centuries) produced his *Literary Mind* (*Wên-hsin tiao-lung*, c.480), a penetrating re-evaluation of the past and a sober criticism of the contemporary scene. In 50 illuminating chapters he examined and analyzed virtually all that there was to be known about literary principles, forms, values, and personalities. Of the same type, but more specialized, was the *Classification of Poets* (*Shih*

P'in), a thorough evaluation of the poets of all periods, by Chung Hung, who lived about the same time. Both works, deeply critical of contemporary writing, heralded a more wholesome age.

A few creative writers, too, had superb achievement. In a painful period of disunion and chaos, the famous Seven Worthies of the Bamboo Grove produced memorable poetry of escape. Their prodigious wine drinking, fantasies about the cosmos, and spiritual escapades were celebrated in inspired verse. Other representative poets were Hsieh Ling-yün (385-433) and Yen Yen-chih (384-456), whose elaborately decorated and cleverly chiseled works portray nature with effects resembling those of pre-Raphaelite painting. Also distinguished was Pao Chao (c.400-466), who wrote poetry with a feeling and expression rare among his contemporaries. But the uniquely great poet of the period was T'ao Ch'ien (T'ao Yuan-ming, 372-427), the Renowned Recluse, who pictured a profound harmony between nature and life, fate and human will, in a flow of effortless and placid verse which was later to be often emulated but never equaled.

The Renaissance and Neoclassicism (7th to 10th Centuries A.D.).—When the brief Sui dynasty, which reunited China, was succeeded by the T'ang, literature entered a new cycle in a splendid age of Chinese history, an age worthily called the renaissance. It sought to realize old values in their proper perspective; benefited, after 300 years of foreign occupation in the north, from the assimilation of many peoples; and experienced an unprecedented blending of Confucianism, Buddhism, and Taoism. It was an age of tolerance and spiritual adventure, of integration and creation. Literature had never been so strongly nor so deliberately stimulated. Since poetry was regarded as an expression of the best minds, verse making was made a requirement in the civil service examinations. Yet it was not merely a means of winning court favor. From the ranks of both court and folk poets arose humanists who produced sharper, more varied, and more numerous pictures of society and of individuals than had the writers of any earlier period. No part of human life was too trivial to be left unsung. The great T'ang poets commanded a wide audience. Not only the court and the intelligentsia, but songsong girls, public entertainers, and the barely literate—all showed a discriminating interest in contemporary verse.

T'ang Poetry.—The poetry of this age developed in four stages: early (c.620-710); heyday (c.710-780); middle (c.780-830); and late (c.830-906).

The Early Period: This period was marked by a demand for a return to classical simplicity and clarity. Although the vogue of artificiality inherited from the preceding age persisted, it was infused with new life by a rising generation of poets. Two favorite courtiers of Emperor Chung Tsung (r. 684; 705-710)—Shên Ch'üan-ch'ü (d. c.713) and Sung Chih-wên (d. c.710)—extracted from the essence of technical poetic theories a form called *lü shih* (regular poetry), which was to develop into one of the finest T'ang types. Although the four-line stanza could be infinitely multiplied to make a *p'ai lü* (extended form), eight lines were the norm, and all had to be of equal length, with five or seven characters. The middle four lines were always strictly parallel couplets with contrasting tones; the other lines

were comparatively free. This form was equally suited to the artificer and to the serious poet who preferred a formal structure. The outstanding poet of the early period was Ch'ên Tzū-ang (656-698), who was recognized by the master poets of the heyday as their only pioneer.

The Heyday of T'ang: In this period T'ang poetry rose to its zenith. Its ascent was prepared by increasing social development and prosperity in China, and accelerated by conflict and suffering. Emperor Hsüan Tsung (Ming Huang, r. 713-756 A.D.), with whom this period began, was a great patron of poetry and the arts during the internally peaceful early years of his reign. There was, however, continuous fighting on the frontiers of the widely expanded T'ang empire and in later years the emperor's extravagance and favoritism precipitated a rebellion against him.

The poets of this period identified themselves with its tragedies and its felicities. The most distinguished were Li Po (701/705-762) and Tu Fu (712-770), who are commonly recognized as the master spirits of Chinese poetry. Both reacted against the immediate past and claimed kinship with the classics, but they were entirely different in temperament. Tu Fu stood for Confucian this-worldliness. He is the great secular poet whose works are realistic etchings of a tormented humanity. In them exquisite scenery and lovely human forms appear in relief against a background of mundane life. Li Po had an affinity for Taoist transcendental naturalism. In his poems magnificent landscape, female beauty, and earthly love are transcended and mirrored in the eternal spirit of the cosmos. The finest works of Tu Fu were written in *lü shih* style, which best suited his exactness and precision of expression. Li Po was most successful in his freely improvised *ku shih* and in the *chieh chu* (curtailed poem), a short song form popular in the T'ang age which was restricted to four even lines but was capable of suggesting infinite overtones.

Among the many other celebrated poets of the T'ang heyday were Wang Wei (699-759), the painter, famous for evoking "poetry in his painting and painting in his poetry"; Meng Hao-jan (689-740), who wrote some of the period's tenderest lyrical verses; Wang Ch'ang-ling (c.700-765), master of the *chieh chü*; and Ts'ên Shên (715-770) and Kao Shih (c.700-765), who left memorable verses about battles and expeditions on the rugged frontiers.

The Middle Period: During the middle period pacification of internal turmoil and resistance to invasion were alternately successful and frustrated. In this Indian summer of the T'ang dynasty poetry developed in a new way with the emergence of two great figures—Han Yü (768-824) and Po Chü-i (772-846)—representing two new schools. Han Yü, celebrated chiefly as a leading advocate of neoclassical prose and a champion of Confucianism, was also an innovator in poetry. His works, which are sometimes marred by argumentative tirades and moral preaching, contain lines of strange beauty, with grotesque images, dissonant tones, and freakish rhymes. Occasionally the ugly and the horrible hold a fascination for him. He influenced Mên Chiao (751-814) and Chia Tao (788-843), both of whom produced perfectly chiseled lines of great originality, and Chang Chi (765-783) who wrote mainly of feminine heartbreak and social injustice. The most extraordinary talent

among Han Yü's friends and followers was that of Li Ho (790-816), whose imaginative power in weaving together the most diverse subjects, and superb sensibility for word music and vivid imagery, earned him the name of ghost genius.

Po Chü-i, who led the other school of this period, had a style so simple and clear that it came close to the language of the people. His famous long poems are actually touching romances in melodious speech. Despite the apparent easy grace and intimate charm of his verses on almost every detail and triviality of daily life, Po was a poet of very serious purpose. With his vernacular diction and commonplace rhymes, he spoke for ordinary people in a way they could understand. Closely associated with him were Yüan Chên (779-831) and Liu Yü-hsi (772-842).

Standing alone between the two schools of the middle period was Liu Tsung-yüan (773-819), the celebrated exile, whose poems about strange landscapes and tranquil natural scenery attained an austerity and spirituality reflecting the strong influence of Buddhist philosophy.

The Late Period: Toward the end of T'ang the imperial court was crumbling and signs of disintegration appeared everywhere. Yet this sunset of a glorious age of poetry was not without splendor. The three leading poets of the period were Tu Mu (803-852), known for his heroic style, and Li Shang-yin (813-858) and Wên T'ing-yün (fl. mid-9th century), whose works were distinguished by their elegance and colorful imagery. The artificiality of their poems, however, was a sign of approaching decadence.

T'ang Prose.—Essays and fiction showed great distinction in the T'ang age. Han Yü and Liu Tsung-yüan, the great middle T'ang poets, were recognized leaders in neoclassical prose writing. Both opposed the florid parallelism which had been in vogue for 500 years. While Han, an ardent Confucianist, wrote vigorous polemic and expository works, Liu, more detached, drew sharply outlined portraits of persons and crystal-clear landscape sketches. The two men perfected many forms of the modern Chinese essay.

The first real fiction was also developed in the T'ang dynasty. Earlier works had been mere fables or naive tales; in the T'ang short stories intriguing plots and vivid characterizations were developed. Among these stories, which were modestly called *ch'uan ch'i* (curious traditions), are gems comparable to the best Western medieval romances. The two most important writers were Yüan Chên, the poet, and Li Kung-tso (770-c.850). Love, chivalry, social satire, fanciful ideas about Buddhist visions, and Taoist mystical experiences were among their favorite subjects. These stories retained their influence on later fiction and drama, continuing to add spice and color to popular beliefs. But their form and content attest the creativeness of the T'ang age, which lifted superstition to the level of imaginative literature.

Contemporary literary criticism is found mainly in the casual but illuminating remarks of the poets and prose writers in their conversations, letters, and private journals. During the declining years of the age, which were marked by a belief in art for art's sake, there developed a vogue for gleaning famous lines of great masters in handbooks called *shih chü i'u* (samples of poetic patterns). Some of the editors of these books showed sound critical sense, but the great critic of the age was Ssü-k'ung T'u (837-908).

In the twilight of T'ang, as if for its swan song, he wrote in superb, impressionistic verse, with the choicest metaphors and similes, a book of criticism called *Poetic Characteristics* (*Shih P'in*), in which he presented the 24 qualities to be desired in poetry. Although the author did not intend to be dogmatic, his work, because of its trenchant aphorisms and melodious style, became a kind of sutra for Chinese poets.

The Five Dynasties.—In the courts of some of the kingdoms into which the country was divided after the fall of the T'ang dynasty, a few tender and sensitive writers composed superb songs of deep nostalgic pathos in the *ts'ü* form, which was to rise into an important genre in the next age.

From the Age of Reason to the Rise of the Drama and the Novel (10th Century to 1900).

—The end of adventurous expansion and the achievement of internal unity ushered in an age of inner reconstruction and philosophical contemplation. The Sung dynasty was an age of masterly prose. In this period the ideas of Confucianism, Taoism, and Buddhism, which had stirred men's hearts in the lyrical T'ang age, were mullied over and subjected to scientific scrutiny. Poetic forms perfected in T'ang now became conventional, but the rarefied music of a form of pure poetry, the *ts'ü*, developed since the decadence of the previous age, came into full flower. And the Sung dynasty must be credited with pioneer novels and plays in which literary craftsmanship contracted a new union with the vernacular, to produce a flowering of creative works in both fields through the Yüan, Ming, and Ch'ing dynasties—a rising tide of vernacular literature which was to culminate in the sweeping vernacular movement of the 20th century.

Sung Prose.—Foremost of the Sung prose writers was Ou-yang Hsiu (1007-1072), a classicist who reacted against artificial parallelism and floridity and favored a return to simplicity and directness. His major accomplishment lay in making prose serve the uses of his time. The flowing style of his political treatises, philosophical dissertations, and essays had a flexibility of rhythm and a clarity of structure unattainable in poetry. His followers included Wang An-shih (1021-1086), the great political reformer, distinguished for his wit and penetrating observation, and the poet Su Shih (Su Tung-p'o, 1036-1101), whose prose writings were brilliantly variegated. Like his master, Su Shih left unsurpassed prose poems. His father, Su Hsün (1009-1066), his brother, Su Chê (1039-1112), and their contemporary, Tsêng Kung (1019-1083), all achieved great distinction. These six, with Han Yü and Liu Tsung-yüan of the T'ang dynasty, are known to Chinese school-boys as the Eight Masters of T'ang and Sung. Prose writers of the Yüan, Ming, and Ch'ing dynasties imitated or criticized their classical style but never surpassed it.

Rationalist philosophers of the Sung dynasty expressed in placid and deliberative prose their ideas of the order of the universe and their theories of knowledge. The commentaries and discourses of Chu Hsi (1130-1200), Lu Chiu-yüan (1139-1193), and others, written in the plainest vernacular, are memorable contributions to lucidity and naturalness of informal style.

Sung Ts'ü Poetry.—The development of the *ts'ü* is another instance of the close relationship between folk and polite literature. It first emerged during the T'ang dynasty as a group of

who gained national recognition was Chou Shu-jen (pen name Lu-hsün, 1881–1936). His poignant satirical novelettes, short stories, and essays brought him to prominence as the most influential critic of modern Chinese society. Hsü Chih-mo (1895–1931) was perhaps the first of the modern Chinese poets who successfully employed the contemporary vernacular to create new poetic forms. Kuo Mo-jo (1891–), novelist, playwright, and poet, very influential since the 1920's, has moved from Goethean romanticism to materialistic historicism.

In the 1930's and 1940's, before and during the Sino-Japanese War, plays and novels characterized by social consciousness and faithful realism were written in increasing numbers. The plays of Wan Chia-pao (pen name Ts'ao Yü, 1909–), which have been translated into several foreign languages, won him acclaim as the most important contemporary dramatist through his mastery of rich and fluent expression in the vernacular, and his penetrating observations of Chinese society in transition.

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SHIH-HSIANG CHEN,
Assistant Professor of Chinese, University of California.

4. DRAMA. In the traditional Chinese theater singing is at least as important as acting. The Chinese refer in ordinary conversation to the drama as either *chü* (song) or *chi* (play), their conception of the art standing in significant contrast to the Western conception of drama as action.

Chinese drama can be traced back to the enchantments practiced by the ancient seers. In the Shang dynasty the *hsi* (sorcerer) and *wu* (sorceress), impersonating deified ancestors and gods, performed ceremonial songs and dances to propitiate the gods and spirits, invoking them to drive out pestilence, send abundant crops, and effect other miracles. The spectators at these performances were moved to join in the dancing. Out of these religious rites and folk dances arose a group of performers and musicians—brothers, historically, to the Chinese acting profession of modern times—employed by the court for the amusement of the emperors and the nobility.

The activity of the court entertainers reached its height in the Han dynasty, when clowns, wrestlers, acrobats, singing girls, and musicians, disguised as gods, fairies, warriors, tigers, leopards, bears, dragons, white elephants, divine turtles, and gigantic birds, enacted mythological stories before Emperor Wu (Wu Ti, r. 140–87 B.C.) and foreign tribute bearers from the western regions.

Formative Period of the Chinese Drama.—Because of the invasion of China by western tribes the music and dance of central Asia had a distinct influence on performances during the period of the Northern and Southern dynasties, as is seen in the warrior dance *Mask of the Duke of Lan Lin*, the revenge dance *Tiger*, and the comic dance *Drunkard's Wife*.

In the T'ang dynasty, Emperor Hsüan Tsung (Ming Huang, r. 713–756 A.D.) showed his in-

terest in the theater by founding at Changan (now Sian) the Pear Orchard, a place for training actors, musicians, and dancers. During the same dynasty there arose a new type of short comic sketch in dialogue form, called *ts'an chün hsi*, using two actors, the *ts'an chün* (leading player) and the *ts'ang hu* (supporting player). These comic pieces, like the other singing and dancing media of the period, had little story interest. They were satires in disguise, sustained by the wit and humor of talented actors and sometimes interlarded with timely political thrusts. The satire was not without hazard, since players were liable to punishment if their allusions to current events incurred the displeasure of royal patrons.

Under the Sung dynasty, with the rising influence of professional story tellers, the *ts'an chün hsi*, by that time known as *tsa chü* or *tsa hsi* (miscellaneous play), gradually shed its satirical and bantering quality and adopted story form. The various stories in a *tsa chü* performance were episodic and unrelated to one another, but the form became more complicated, with four principal characters and two subordinate characters. The dancing and singing which accompanied the performance became essential features of the Chinese legitimate theater. This simple type of *tsa chü* was the forerunner of the theater of the southern school, which flourished in both Hangchow and Yungkia (Wenchow). Records of the 13th century list titles of 280 *tsa chü* plays of the Southern Sung dynasty.

Yüan Drama.—After a period of incubation in northern China under the alien Chin dynasty, there arose during the Yüan dynasty the theater of the northern school, which represented a great advance over the *tsa chü*. Prosperity and peace created an unprecedented demand for the theater. Although the arts in general were ignored by the Mongol rulers, the theater, being responsive to a less cultivated but wider public than other art media, became the most vital literary expression of the time. When the Mongols abolished the civil service examinations, many Chinese scholars, for want of a better means of self-expression, turned to writing for the theater. By this time the drama of the northern school had evolved into its mature form, with four acts, a prologue, an epilogue, and an interlude for the exposition of a full-length story. In the hands of the dramatic talent of the day, action held the stage in place of narration, dialogue became dramatic and colorful, and metrical forms were much more varied.

The age of Yüan was unrivaled in its abundance of excellent plays. Among the best known are *The Sorrows of Han*, by Ma Chih-yüan; *The Sufferings of Tou-E*, by Kuan Han-ch'ing; *The Slave of the Treasure*, Chinese counterpart of Molière's *L'Avare*; *The Orphan of the Chao Family*, a tragedy distinguished by sublimity of conception and character; and *The Romance of the Western Chamber* (*Hsi-hsiang chi*), a romantic play of youthful love, written with rare beauty and inimitable literary flourish by Wang Shih-fu. These plays have been published in various languages, the earliest translation being Voltaire's adaptation of *The Orphan of the Chao Family*, which he called *L'Orphelin de la Chine*. The Yüan play which has been performed most frequently in Europe and the United States is *The Chalk Circle*, by Li Sing-tao.

At the end of the Yüan dynasty, as the theater

of the northern school began to decline, Kao Ming (courtesy name Kao Tsê-ch'eng, fl. mid-14th century), the earliest scholar of the theater of the new southern school, wrote his immortal play, *The Story of the Lute* (*P'i-p'a chi*), a complicated 42-act (in some versions, 24-act) development of the theme of filial piety, depicting the life of Chao Wu-liang, the idealized daughter-in-law of a scholar's family. In 1945 this play was presented in a form considerably shortened and mildly adapted in the New York musical success, *Lute Song*.

Drama in the Ming and Ch'ing Dynasties.—In the Ming dynasty, Wei Liang-fu (fl. mid-16th century), a musical genius of the south, introduced the epoch-making *k'un-ch'ü* school of singing. It became at once admired and influential and gradually forced the northern school theater of the Yüan period out of existence. During the ascendancy of the *k'un-ch'ü* school, T'ang Hsien-tsu (Tang Shien-chu, 1550–1617), one of its great masters, wrote his five romantic plays, of which *Peony Pavilion* (*Mu-tan t'ing*), in 55 acts, is the best example of his exuberant imagination and of his aptitude for portraiture and literary embellishment. Among the writers who tried to emulate his writing, and to excel him in metrical harmony, was Yüan Ta-ch'eng (d. 1645), a high official of the declining Ming dynasty. His best work was the play, *The Swallow as Go-between*, the love story of a singsong girl. In the Ming period the theater of the southern school reached its zenith. More than 100 of its plays survive.

The *k'un-ch'ü* school of singing continued to hold an indisputable position among numerous Chinese theater troupes during the first 150 years of the Ch'ing dynasty. Authors who professed allegiance to the Ming dynasty rather than to the foreign Ch'ing dynasty gave vent to their repressed sentiments in dramatic form. The most notable works of this period are *The Palace of Eternal Life* (*The Immortal Palace*, *Ch'ang-shêng tien*), by Hung Shêng (1646?–1704), a play based on the tragic love of Emperor Hsüan Tsung and his mistress Yang Kuei-fei; and *The Peach Blossom Fan* (*T'ao-hua shan*), by K'ung Shang-jên (1648–1718), on the theme of love and patriotism—a dirge among the ruins of the fallen dynasty. The period also saw the first attempt by a Chinese scholar to study dramatic construction, in an essay called *Casual Talks in Idle Hours* (*Hsien-ch'ing ou-chi*), by Li Yü (1611?–1680). In general, Ch'ing drama compares favorably in quality with that of the Ming dynasty.

After a short period of imperial patronage at the court of Emperor Ch'ien Lung (r. 1736–1794), the theater of the *k'un-ch'ü* school began to fall out of public favor because of its overelaborate poetic language and excessive refinement. Out of the melting pot of many theater troupes the *p'i-huang* school of the theater emerged to take the fancy of the common people. Its plays, still cherished as the most popular form of entertainment in China, are rarely of literary value; yet they have attracted a number of accomplished actors, greatest among whom is Mei Lan-fang (1894–).

Chinese Drama, Ancient and Modern.—Dramatic writing, an art long despised and neglected, had a late growth in China. The literati, who took to writing for the theater as a last resort, did not deign to learn the craftsmanship required by the form, but merely exploited it as a

vehicle for the exhibition of their literary achievements and imaginative ingenuity. At its best this kind of dramatic writing contains scenes of true sentiment, rich in poetic beauty and dramatic at fleeting moments. Yet, with few exceptions, Chinese plays of the old school are not well constructed. Victims of overattention to poetic justice, neglect of the logic of character, and indulgence in long-winded narrative, they lack the balance demanded by Western dramatic standards. Nevertheless, a study of the techniques used in producing these plays shows that, while generally lacking in realism, they can soar into flights of unhampered imagination and impart a feeling of pure theater.

The old Chinese theater is an art based on music. It combines singing, dancing, acrobatics, pantomime, and highly stylized acting. To appreciate its grace and beauty, and its sense of theatrical truth, one must bear in mind the fundamental conception of the Chinese playgoer that the theater is at best an illusion of life, to be evoked by the suggestiveness of acting and music and by the imagination of the spectator. The Chinese stage is almost as bare as the Elizabethan stage. It has a protruding square platform with no scenery and no curtain, and is faced on three sides by the audience. In the center hangs a decorative backdrop with openings at right and left for entrance and exit. The orchestra, which sits on the right side, is conducted by the player of the small drum, the sounds of which accentuate, with meticulous precision, every movement of the actors. Usually the orchestra comprises a "civil" part, with a Chinese violin, a flute, a Chinese moon guitar, and a Chinese cornet; and a "military" part, consisting of a big drum, a big gong, a small gong, and cymbals. The property man, who sets up the chairs, tables, kneeling cushions, and other simple properties, is never obtrusive and, so far as the audience is concerned, scarcely exists. The acting is entirely conventional. But its patterns seem beautiful and convincing when they are enlivened by the well-disciplined art of accomplished actors. The character parts, also conventional, are divided roughly into four major types of roles: the *shêng*, or male characters; the *tan*, or female characters; the *ching*, or characters with painted faces; and the *ch'ou*, or comedian. Until the revolution of 1911, all these characters were impersonated by men. With an oar standing for a boat, a whip for a horse, a table for a hill, a flag with the picture of wheels for a cart, and a painted cloth for a city wall, the genius of the Chinese theater succeeded in presenting, in its every aspect, the many-sided life of old China.

Modern Chinese drama has broken away from the traditions of the classic Chinese theater. Differing from the old in both form and spirit, it represents a revolution in dramatic technique. About 1900 politically conscious intellectuals, in an effort to depose the Manchu regime and to modernize their country, turned to the Western theater for inspiration and support. A great number of Western plays, including those of Henrik Ibsen, George Bernard Shaw, Anton Chekhov, and Eugene O'Neill, as well as the classics of every age, were translated, and some of them performed. Borrowing Western techniques of playwriting and production, talented dramatists and directors initiated a new theater, called *hua chi* (spoken drama), as distinguished from the old school of music drama. A drama of social

significance, its topical themes and varied production techniques have won the approval of the modern Chinese public. The new theater, alert to the impress of reality, reflects the life and thought of the people of China in their own everyday speech, in striking contrast to the classical verse of the old theater, with its stories of scholars, warriors, and kings. The new theater endeavors to be modern in form, yet distinctly Chinese in content. *Hua chi* occupies an unprecedented position in modern Chinese literature, exerting a far-reaching influence over the common people in their adjustment to the contemporary world. See also DRAMA; ORIENTAL THEATER.

CHIA-PAO WAN,
Dramatist and Teacher

5. MUSIC. To understand Chinese music we should know something of its history, of the theories upon which it has been based, of the practices arising from the application of these theories, of the major Chinese musical instruments, of the various systems of notation, and of the influence of the language upon musical development.

Historical Development.—According to Chinese historical records, Chinese music can be traced back more than 4,000 years. Through the centuries, that music has been based on the Chinese standard pitch, called *huang chung* (literally, yellow bell). The ancient Chinese believed that the production of sound, as one of the elements of the cosmos, had much to do with the harmony of the universe. Other elements, such as time, space, and matter, were beyond the control of man, but he could create sound. By the sound he created he either strengthened the welfare of the nation or endangered it. For this reason, one of the most important duties of the first emperors of new dynasties was to regain the true pitch of *huang chung*. The exact pitch of *huang chung* is still a mystery, since measurements varied from one dynasty to another, and the standard "nine-inch" length of *huang chung* was longer or shorter than nine inches in various dynasties.

The role of music in society, education, and government was brought to its highest point of development by Confucius, who advocated government by rituals and music, favored the kind of music that would calm the passions and feed the heart, and condemned the lewd music of Chêng, the "Lyian airs" of China. His influence has been strong for more than 2,400 years. During the wholesale slaughter of scholars and the burning of books under Shih Huang Ti (r. 247 or 246–210 B.C.) of the Ch'in dynasty, innumerable music manuscripts and treatises were lost, and with them many musician scholars. These losses proved a serious blow to musical development. The emperors of the succeeding Han dynasty paid particular attention to the revival of old music.

Music reached its highest peak in the T'ang dynasty, when huge orchestras, numbering from 500 to 700 instruments, performed at the imperial court. Since this climactic period there has been a gradual decline in music in China, especially since the 17th century. It is said of certain music that Confucius, after hearing it, forgot the taste of meat for three months. This the Chinese now speak of as the "lost music." In the 20th century Western music has drawn an increasing

number of Chinese converts, many of whom have little regard for their own music.

Musical Theories.—The principal Chinese tonal system is the *lü-lü* system, consisting of 12 pipes—6 male *lü* (fourth tone) and 6 female *lü* (third tone). The longest pipe is the standard pitch pipe, the *huang chung*, which, by *san fên sun fa* (method of adding and subtracting by thirds), begets all the others. The second pipe is related in length to the first in the ratio of 2:3; the third to the second in the ratio of 3:4; the fourth to the third in the ratio of 2:3; and so on to the twelfth pipe. Since the result of this system is identical with that of the Pythagorean system of cyclic fifths, some musicologists believe that the Chinese system was derived from that of the ancient Greeks. This conclusion is probably unjustified, since Pythagoras based his system on strings, while the Chinese system was based on pipes. (See PYTHAGOREANISM.)

Unfortunately, the thirteenth pipe produced by the Chinese method did not yield the true octave and all the pipes were not uniform in pitch interval. It was therefore impossible to obtain the ideal of *hsian hsian wei kung* (every *lü* alternately serving as tonic). For this reason, in about 45 B.C., Ching Fang added 48 more *lü*, bringing the total to 60. About 438 A.D., Ch'ien Yüeh-chih found the 60-*lü* system also inadequate. He therefore added 300 more *lü*, raising the total to 360. It became mathematically clear that the sequence based on the 3:2 ratio could never hit the true octave, which requires a ratio of 1:2 to the fundamental tone. In 1596 A.D., Prince Chu Tsai-yü of the Ming dynasty theoretically established the equally tempered scale, more than 100 years before it was worked out in Europe.

The first 5 of the 12 *lü* form the Chinese five-tone scale, represented by the black keys on the piano keyboard beginning with F Sharp. This has been the basic scale of Chinese music from the earliest periods to the present day. The notes are called *kung*, *shang*, *chiao*, *chih*, and *yü*. In the Chou dynasty the sixth and seventh *lü* were added to this scale, the new notes being called *pien-kung* and *pien-chih*, and falling, respectively, a half tone below *kung* and a half tone below *chih*. This is the Chinese seven-tone scale; compared with the Western diatonic major scale, it has a raised fourth. In traditional Chinese music transposition was of major importance. Each *lü* was related to a certain month, and melodies played in each month had to be in the appropriate key. There were various modes, many melodies being written in the *shang* mode, for example, others in the *chiao* mode, and so on.

Musical Practice.—Chinese music is divided into four classes: ceremonial music, chamber music, operatic music, and folk music. The ceremonial music is said to have been "lost." It was slow and dignified, with long-drawn notes of equal length. When sung, it always had one note to a word. Music for the *ch'in* (zither) and *p'i-p'a* (lute) is the most highly developed category of chamber music. Elaborate techniques developed, and many special handbooks were written for these two instruments. An older type of operatic music, called *k'un-ch'ü*, is usually serious. The *ti-tsü* (flute) is its main accompanying instrument, and it may be traced back to the Yüan dynasty. A much later type of opera, *p'i-huang*, which originated about 1850, has the *hu-ch'in* (two-stringed violin) as its main accompanying instrument. It has become very popular and has

largely replaced the *k'un-ch'ü*. Folk music, though almost entirely neglected for centuries by scholars and musicians, has continued to live in the hearts of the people. It reflects the character and life of the Chinese nation.

Chinese music is played or sung largely in unison, sometimes employing parallel fourths and fifths. Its rhythm is most frequently based on the four-measure line. Its melody, because of the influence of the Chinese language, is usually more liquid and more florid than that of the West.

Musical Instruments.—Traditionally, Chinese musical instruments are classified into eight families according to the materials from which they are made: metal (*chung*—bell); stone (*ch'ing*—sonorous stone); silk (*ch'in*—zither, which has silk strings); bamboo (*p'ai hsiao*—panpipes); gourd (*shêng*—mouth organ); clay (*hsün*—ocarina); skin (*ku*—drum); and wood (*yü*—"comb-backed tiger" for stopping the performance). Many types originating among non-Chinese tribes or in foreign countries were later absorbed into the family of Chinese musical instruments.

Notation.—There are two kinds of Chinese musical notations. The first pertains to the instrument (where to stop the string, which bell to strike) and the method of playing (which finger to use, how to pluck the strings, how to stop them as required). The second indicates which pitch (absolute or relative) is to be produced. Neither gives a graphic picture like that presented in Western staff notation. The *lü-lü* notation, using the first characters of each of the 12 *lü* names, originally belonged to the first type and was later developed into the second. The *kung-shang* notation, using scale names, belongs to the second type and is used like the Western movable-do system. The *kung-ch'e* notation, using 10 characters and their modifications to represent various pitches, originated from the notation of certain wind instruments and was later adapted to other instruments and to vocal music. In the *ch'in* notation, used exclusively in playing instruments of the *ch'in* type, a single symbol indicates what, where, and how both hands are to play. The *p'i-p'a* notation, use of which is limited to the instrument of the same name, is a combination of the *ch'in* and *kung-ch'e* notations.

The *ch'in* and *p'i-p'a* notations are still used for their respective purposes, while the *kung-ch'e* notation is used in music of the old school. In addition, numerical notation has been introduced from Japan; Western staff notation is used increasingly in the schools; and the tonic sol-fa notation is used in some church schools.

Influence of Language on Music.—The tonal and basically monosyllabic character of the Chinese language has had a tremendous influence on Chinese music. There is a natural tonal curve in the spoken language. When words are set to music, the melodic curve does not go its own way regardless of the already established tonal curve of the text. Moreover, each of the four inflections of Standard Chinese (Mandarin) has a tendency of its own, calling for special treatment. (See section on *Language*.)

The characteristic tonal features of Chinese music give it a flow and a floridity deeply satisfying to the Chinese ear. Centuries ago the influence of these elements penetrated the realm of instrumental music. They are basic in the music of modern China, and of potential benefit to the entire musical world.

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PAO-CH'EN LEE,

Former Dean, National Conservatory of Music, Chungking.

6. ART. Architecture, painting, and sculpture have long been regarded as the three principal fine arts, and these alone will be treated in this article. For an account of the fascinating minor art of pottery and porcelain, see section on *Ceramics*; for bronzes, see *BRONZE*.

ARCHITECTURE

Although the ancient Chinese never considered architecture a fine art, in China as in the West it has been the mother of the fine arts. It was through the medium of architectural decoration that painting and sculpture gradually matured and gained recognition as independent arts.

Technique and Forms.—The architecture of China is an indigenous system of construction which was conceived in the dawn of Chinese civilization and has been developing ever since. Its characteristic form is a timber skeleton or framework standing on a masonry platform and covered by a pitched roof with overhanging eaves. The spaces between the posts and lintels of the framework may be filled in with curtain walls whose sole function is to separate one portion of the building from another, or the interior from the exterior. The walls of the Chinese building, unlike those of the conventional European building, are free from the weight of the upper floors and the roof, and may be installed or omitted as required. By adjusting the proportion of the open and walled-in spaces, the architect may admit or exclude just the amount of light and air appropriate to any purpose and to any climate. This high degree of adaptability has enabled Chinese architecture to follow Chinese civilization wherever it has spread—to Korea and Japan in the east, to Sinkiang in the west, to Indochina in the south, and to the Siberian border in the north.

As the Chinese system of construction evolved and matured, rules like the orders of classical European architecture were developed to govern the proportion of the different members of the building. In buildings of a monumental character the order is enriched by *tou-kung*, sets of brackets on top of the columns supporting the beams within and roof eaves without. Each set consists of tiers of outstretching arms called *kung*, cushioned with trapezoidal blocks called *tou*. The *tou-kung* are functional members of the structure, carrying the beams and permitting the deep overhang of the eaves. As they evolved, they assumed different shapes and proportions. In earlier periods they were simple and large in proportion to the size of the building; later they became smaller and more complicated. Hence they serve as a convenient index to the date of construction.

The planning problem of the Chinese architect is not that of partitioning a single building, since the framing system makes the interior partitions mere screens, but of placing the various buildings of which a Chinese house is composed. These are usually grouped around courtyards, and a house may consist of an indefinite number of such courtyards. The principal buildings are usually oriented toward the south, so that a maximum amount of sunlight can be admitted in winter, while the summer sun is cut off by the overhanging eaves. Apart from the variations required by special topographical conditions, the same general principles apply to all domestic, official, and religious architecture.

Historical Development.—The oldest architectural remains in China are some tombs of the Han dynasty. Both the burial chamber and the *ch'üeh*, or gate piers, include translations into stone of timber construction, showing a highly accomplished carpenter's art rendered by an equally masterful touch of the sculptor's chisel. The important role played by the *tou-kung* is seen even in that early period.

No timber structure built during the long interval up to the middle of the 8th century A.D. has as yet been found standing in China. Yet glimpses of the outward appearance of such structures may be gathered from the details of construction in some of the cave temples and from the paintings on their walls. In the caves of Yunkang, near Tatung, Shansi, constructed about 452-494 A.D., and in those of Hsiangtang Shan, on the border of Honan and Hopeh provinces, and Tienlung Shan, near Yanku (Tai-yuan), Shansi, which were built about 550-618 A.D., the façades and interiors are treated architecturally, carved from the rock cliffs to emulate the contemporary timber structures. On the tympanum of the west portal of the Tz'u-en Ssü pagoda (701-704 A.D.), in Sian (Changan), Shensi, is an engraving showing in accurate detail a Buddhist temple hall. The frescoes on the walls of the 6th to 11th century caves at Tunhwang, Kansu, are paradise scenes with elaborate architectural backgrounds. These relics are graphic records of the architecture of a period that has left us no standing specimens. Here, too, we notice the importance of the *tou-kung*, whose evolution may be clearly traced.

Such indirect evidence of the character of early Chinese architecture is well supported by groups of buildings still standing in Japan. They were erected in the Suiko (Asuka), Hakuho, Tempyō, and Kōnin (Jogan) periods, corresponding to the Sui and Tang dynasties in China. In fact, until the middle of the 19th century the architecture of Japan reflected as in a mirror the changing styles of continental builders. The early Japanese structures may justifiably be called colonial Chinese, and some are actually known to have been erected by continental architects. Earliest of these is the Hōryūji group, near Nara, which was constructed by Korean builders and completed in 607. Another is the Kondō of the Tōdaiji, Nara, built by the Chinese monk Ganjin (Chien-chên, d. 763) in 759.

The oldest extant wooden structure in China itself is the main hall of the Buddhist temple Fo-kuang Ssü, Wutai, Shansi. It is a one-story building of seven bays, with *tou-kung* of gigantic size, showing an unparalleled vigor and dignity in proportion and design. The temple was built in 857, shortly after the nationwide

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Upper left: T'ai-ho Tien, Imperial Palace, Peking. Left: The main hall of the Buddhist temple Fo-kuang Ssü, Wutai, Shansi, the oldest extant wooden structure in China, built in 857 A.D. Right: T'ien-ning Ssü pagoda, Peking.

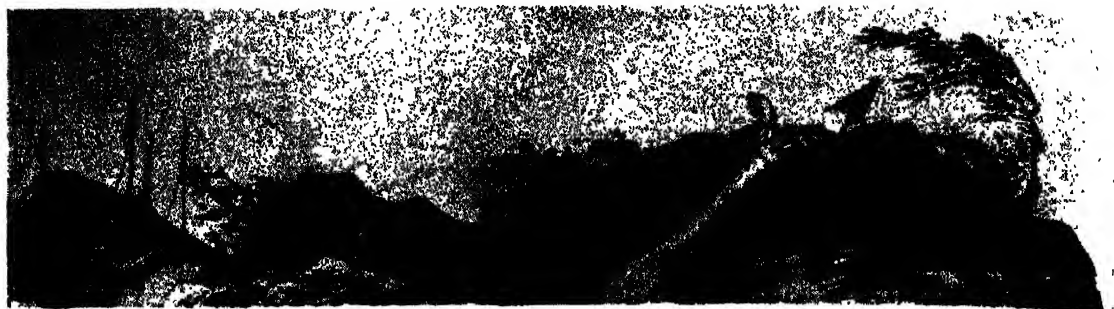


CHINESE ARCHITECTURE

Above: The Great Stone Bridge, Chaoh-sien, Hopeh.
Right: The 15-story pagoda of Sung-yüeh Ssü, Sung Shan, Honan. Far right: The stupa of Miao-ying Ssü, Peking



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Courtesy Smithsonian Institution, Freer Gallery of Art

Tai Chin (Tai Wên-chin, fl. 1430–1450) painted "Breaking Waves and Autumn Winds" in the middle of the 15th century, Ming dynasty (1368–1644).



Courtesy The Art Institute of Chicago

T'ang Yin (1470–1523) painted the scroll, of which this is a section, called "Scholar Receiving Buddhist Friend," in 1509. Ming dynasty.



Courtesy Museum of Fine Arts, Boston

This landscape scroll of mountains and water was done by Tung Yüan. Late 10th century. Sung dynasty (960–1279 A.D.).

Buddhist persecution of 845. It is the only wooden structure known to date from the T'ang dynasty, the golden age of Chinese art. The hall houses specimens of sculpture and calligraphy and a fresco frieze, all of the same period. The congregation in one spot of all the major arts of T'ang date makes this temple and its contents a unique treasure in China.

Wooden structures of later periods are found in increasing numbers. A few of the more outstanding monuments may be chosen to represent the Sung dynasty, together with the contemporaneous Liao and Chin dynasties.

The Hall of Kuan-yin (Goddess of Mercy) of the Tu-lo Ssü, Chih-sien, Hopeh, was built in 984. It is a two-story structure containing an eleven-headed Kuan-yin, standing upright. A mezzanine story is inserted between the two main stories, so that the structure is actually built of three superposed "orders." Here the function of the *tou-kung* is shown to best advantage.

The group of buildings at Tsintzu, near Yanku, was built about 1025. The two principal buildings are each one story in height, but the main hall has double-decked eaves. The main hall of the Hua-yen Ssü, Tatung, is a huge single-story structure with single-decked eaves. Built about 1090, it is one of the largest Buddhist structures in China. Of considerably later date (1260) is the main hall of the Pei-yüeh Miao, Chuyang, Hopeh. The inner structural members supporting the upper part of the roof have been extensively rebuilt, but the lower part and the outward appearance of the building as a whole are essentially unaltered.

A comparative study of these few examples reveals that the *tou-kung* tends to become smaller and smaller in proportion to the building. Another common characteristic is an increase in the height of the columns toward the corners of the building. This latter refinement brings about a gentle curvature of the eave line (with the exception of the Hua-yen Ssü hall), and of the roof ridge, giving an appearance of great elegance.

With the coming of the Ming dynasty, the subtle refinements disappeared. This trend is especially noticeable in the monuments built under imperial patronage, and is best exemplified in the sacrificial hall at the tomb of Emperor Chu Ti (reign name, Yung-lo), built in 1425 at Changping, Hopeh. Here the *tou-kung* has shrunk to insignificance; its presence can be detected only at close view.

Despite the retrogressive features of individual buildings of the Ming and Ch'ing dynasties, we have in the imperial palaces of Peking a superb example of planning on the grandest scale, showing the aptitude of the Chinese for conceiving and executing a design of colossal proportions. The hundreds of audience halls and apartments within the Forbidden City, a walled enclosure measuring about 3,350 feet by 2,490 feet, are mainly structures of the late Ming and the Ch'ing dynasties. The entire area was conceived as a single architectural unit, with one main axis dominating the Forbidden City and the entire Imperial City surrounding it. The halls, pavilions, verandas, and gates are grouped in innumerable courtyards connected by colonnades. The buildings themselves are raised on white marble terraces. Columns and walls are generally painted red, while the *tou-kung* are decorated with intricate designs in blue, green,

and gold, forming a cool belt which accentuates the deep, shady overhang of the eaves. The whole structure is crowned by a roof of glazed yellow or green tiles. The ingenuity of the Chinese in applying color to architecture on an all-inclusive scale has never been equaled.

Multistoried Timber Structures.—Because of the limitations of the material, high structures in timber are rare. The best known is the Ch'i-nien Tien of the Temple of Heaven, Peking. It is a building of circular plan, standing on three tiers of white marble terraces and crowned by three tiers of blue glazed tile roofs, the uppermost of which converges into a cone whose apex is about 108 feet above the ground.

The finest example of multistoried timber construction in China is the little-known wooden pagoda of Yinghsien, Shansi. Erected in 1056, it is a five-story structure with four additional mezzanine stories, built on an octagonal plan. Each of its main and mezzanine stories is a complete "order" in itself. The pagoda as a whole therefore comprises nine superposed "orders." Scarcely any of its members is idle: every timber has its part in supporting the building. The top roof, which is an octagonal cone, is surmounted by a wrought iron spire whose tip is 215 feet above the ground. Although most of the early pagodas were of wood, this is the only one of its kind still standing in China.

Masonry Pagodas.—The early wooden pagodas have disappeared, but many of their counterparts in brick—or, in rare cases, stone—have survived the destructive forces of man and nature. Contrary to the general assumption, the design of the Chinese pagoda was not imported from India; rather, it is a cross between the architectural ideas of the two civilizations. The body is entirely Chinese, the Indian element finding expression only in the spire, which is derived, often in much modified form, from the stupa. Many of the pagodas are brick and stone translations of wooden prototypes embodying the traditional Chinese architectural conceptions.

Chinese masonry pagodas may be divided into five principal types:

One-Story Pagodas.—A stupa is a monument marking the site where some Buddhist relic is buried; the tomb stupa of a deceased monk may properly be called a pagoda. Most of the tomb stupas of the 6th to the 12th centuries are small, square pavilionlike structures, one story high, with one or two strings of cornices. The earliest examples of the one-story form is the Ssü-mên T'a (which is not a tomb), built in 544 near Tsinan, Shantung. More typical is the tomb of Hui-ch'ung at Ling-yen Ssü (mid-7th century), Changching, Shantung.

Multistoried Pagodas.—The multistoried pagoda retains most of the characteristics of the indigenous multistoried building. Counterparts in wood are still extant in Japan, but only brick structures of this type remain in China. One of the earliest and best examples is the Hsiang-chi Ssü pagoda, built in 681, near Sian. It is a square pagoda of 13 stories, 11 of which are intact. The stories are marked by strings of corbeled cornices, and the exterior walls of each story, in addition to their doorways and windows, have delicate reliefs of simple pilasters and architraves supporting *tou*.

In the Sung dynasty the octagonal plan became general. Representation of columns or pilasters on the walls is often omitted, but the

cornices are in most cases supported by numerous *tou-kung*. In some instances, such as the twin pagodas of Tsohsien, Hopeh (c.1090), the outward appearance of the wooden pagoda has been faithfully reproduced in brick.

Multi-eaved Pagodas.—The multi-eaved type seems to be a mutation of the single-story pagoda, produced through increasing the number of cornices. In appearance, it presents a high main story crowned by a great number of closely decked eaves. The earliest example is the 12-sided, 15-story pagoda of Sung-yüeh Ssü, built about 520, on Sung Shan, a sacred mountain in Honan. During the T'ang dynasty the square plan was the only one chosen for this type of pagoda. The pagoda of Fa-wang Ssü (c.750), also on Sung Shan, is an excellent example.

The octagonal plan was introduced about the middle of the 9th century and after the 11th century became accepted as the standard shape for a pagoda. A great number of pagodas of this type, enriched by *tou-kung* under the eaves, were built in north China from the 10th to the 12th centuries. The best-known example is the pagoda of the T'ien-ning Ssü, Peking, a structure of the 11th century which has been much repaired.

Stupas.—The stupa in its original Indian form, though known in China through the early Buddhist missionaries, was never transplanted there. When the stupa finally did become established in China, in much modified form, it arrived through Tibet in conjunction with the spread of Lamaism. The Tibetan stupa is generally bottle shaped and raised on a high base. The best example is the stupa of Miao-ying Ssü, Peking, which was built in 1260 by Kublai Khan. Later the bottle became more slender, particularly the neck. This part, which originally resembled a truncated cone, came to resemble a smokestack. Typical of the later stupas of the Tibetan type is the one in North Lake Park, Peking, built in 1651.

Diamond-Based Pagodas.—The *chin-kang pao-tso t'a*, or diamond-based pagoda, consists of a group of pagodas on a common base. Its development was foreshadowed as early as the 8th century in the pagoda group of Yün-chü Ssü, Fangshan, Hopeh, which is composed of a large pagoda and four small ones on a single, very low platform. The form did not reach full architectural maturity until the Ming dynasty. An excellent example is the Wu-t'a Ssü (Five Pagoda Temple), built in 1473 outside one of the west gates of Peking. This structure reminds the observer in various ways of the 8th century Boro Budur in Java.

Beamless Halls.—As we have noted, timber has always been the principal Chinese building material, and pure masonry is seldom used except in pagodas and bridges. Toward the end of the 16th century, however, a few vaulted brick buildings were constructed. Their exteriors conform to the Chinese "order" of architecture in much the same way as the façades of the Renaissance buildings of Europe conform to the classical Greek and Roman orders. Inside, the dome and even the pendentives are ingeniously treated with tiers of cantilevering *tou-kung*.

This type of architecture never became popular in China, and existing examples are rare. Outstanding among them are the beamless hall of the Yung-Chao Ssü, built in 1595 near Yanku, and that of the K'ai-yüan Ssü, in Wuhsien.

P'ai-lou.—In most of the towns and on many of the country roads of China are found monumental archways called *p'ai-lou*. Although the *p'ai-lou* is considered a purely Chinese architectural concept, one cannot fail to notice an analogy between this form and the gateways of the railings surrounding certain Indian stupas, such as those of Sanchi. In south China stone *p'ai-lou* are common; in northern cities the street scene is often enlivened by gaily painted timber ones.

Bridges.—The building of bridges is an ancient art in China. Early examples were either simple timber structures or pontoon bridges, and it was not until the middle of the 4th century A.D. that the arch was used to span a water barrier. The most notable example of Chinese bridgebuilding is the Great Stone Bridge, Chaohsien, Hopeh. This is an open-spandrel bridge (one with small arches piercing the triangular space between the roadway and the ends of the main arch) whose principal arch has a span of 123 feet. Built in the Sui dynasty, it is a feat of engineering to amaze even a modern engineer. The commoner type of bridge, exemplified by the celebrated Marco Polo Bridge near Peking, uses intermediate piers. Suspension bridges are often employed in the mountainous regions of south-western China, and bridges with huge stone lintels, sometimes measuring 70 feet or more, are not uncommon in Fukien.

PAINTING

Painting as an art first appeared in China in the form of decorations on banners, dresses, gates, walls, and other surfaces. The aesthetic appeal and suggestive power of this medium were utilized by kings and emperors of the earliest days as a convenient means of teaching and governing the people.

Pre-T'ang Painting.—In the Han dynasty the art of painting reached technical maturity and murals were used to decorate the interiors of halls and palaces. In 51 B.C., Emperor Hsüan Ti (r. 73-49 B.C.) ordered portraits of 11 of his ablest generals and ministers, who had brought about the surrender of the *shan-yü* (king) of the barbarian Hsiung-nu, painted on the walls of Ch'i-lin Ke—an indication that portrait painting had already become a recognized art. Paintings were executed on walls and on silk. A considerable number of paintings on silk are reported to have been included in the imperial collections of the T'ang dynasty, but these have disappeared.

A painted brick discovered in a tomb at Naknang (Lolang), Korea, which was the capital of a Chinese province from 108 B.C. to 313 A.D., is in the Museum of Fine Arts, Boston. (This museum and the British Museum in London contain the best collections of Oriental art outside Asia.) It affords a glimpse of painting in a frontier province of the great Han empire. Numerous stone slabs with designs engraved or in relief also provide indirect but valuable evidence of the character of Han mural painting.

The oldest existing Chinese scroll painting, attributed to Ku K'ai-chih (344?-2406 A.D.), is treasured in the British Museum. Ku K'ai-chih was a celebrated painter of the Tsin (Chin) dynasty. The scroll, probably a T'ang copy, is labeled *Admonitions of the Instructress to the Court Ladies* and depicts scenes illustrating a series of proverbs or morals. The figures are

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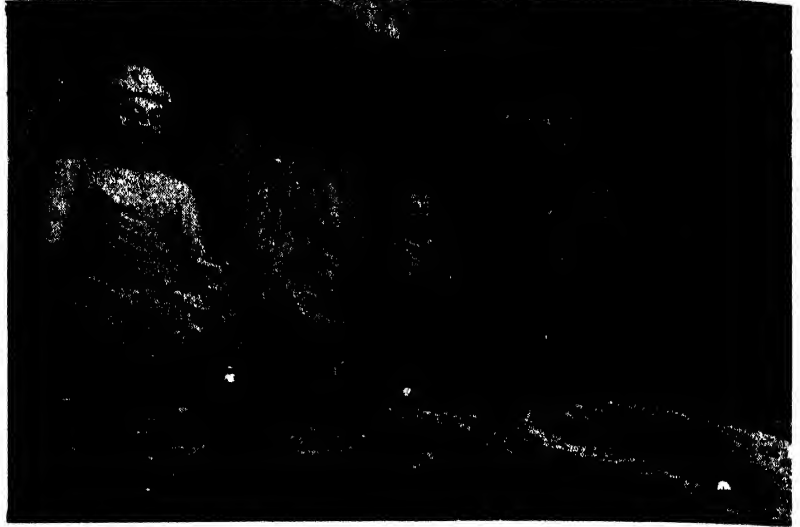


CHINESE PAINTING

Above: A painting on paper called "Grapevine in Wind," signed Wang Liang-ch'en. Ch'ing dynasty (1644-1912). Top right: An eight-fold screen of carved and painted lacquer. Nineteenth century. Center right: Detail of a scroll painting, "Early Autumn," by Ch'ien Hsüan (1235-c.1290). Yuan dynasty (1260-1368 A.D.). Bottom right: Detail of painting by Mi Fei (1051-1107), ink on silk, called "Misty Landscape." Sung dynasty (960-1279 A.D.).

(Above, bottom right) Smithsonian Institution, Freer Gallery of Art; (top right) The Metropolitan Museum of Art; (center right) The Detroit Institute of Arts

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(Left) Courtesy Smithsonian Institution. Freer Gallery of Art

Left: Terminal ornament of marble, c.12th century B.C. Late Shang—Early Chou dynasties (1523–256 B.C.). **Right:** Colossal Buddha, Lungmen, Honan. Note comparative size of the man standing at figure's feet. Early centuries A.D.



CHINESE SCULPTURE

Center left: Seated wooden figure of Kuan-yin. Sung dynasty (960–1279 A.D.). **Center:** A Bodhisattva, from the Rockefeller Collection. **Center right:** A Bodhisattva from Yunkang. Early centuries A.D. **Left:** Bodhisattva, Tatsu, Szechwan. Sung dynasty.

(Center left) The Art Institute of Chicago; (center right) The Metropolitan Museum of Art, New York

painted with a brush on silk, in lines of great accuracy and dexterity, but no attempt was made to set them against a background. The painting shows conceptions of the human form and of space which still adhere to some extent to the archaic methods of presentation on the Han relief stone slabs. Yet it also contains the essential characteristics of the 5th and 6th century Buddhist sculpture.

Painting of the T'ang Dynasty.—Painting, like other branches of art, blossomed into its full glory during the T'ang dynasty. Yen Li-teh and his brother Yen Li-pên (c.600–673) are the first of a long list of great T'ang painters. Li-teh was also an architect, while Li-pên was the greater painter. Attributed to the latter is the scroll *Portraits of Emperors and Kings*, in the Museum of Fine Arts, Boston, in which many of the characteristics of the Ku K'ai-chih scroll are traceable.

Wu Tao-tzu (c.700–760) became the most celebrated Chinese painter. The first to make full use of the flexibility of the brush, he employed undulating lines varying in thickness, with third dimensional effects. This was a radical departure from the wirelike lines of the earlier painters and gave him greater freedom of expression. "Wu's wind-blown draperies" became a phrase familiar to every student of Chinese painting, and succeeding painters depicted movement ever more vividly. Wu, with his free and masterly brush, excelled in painting subjects of all kinds, sacred and secular—figures, animals and plants, landscape, and architecture. The number of his murals recorded in the *Li-tai Ming-hua Chi* (*Famous Paintings of All Ages*) by Chang Yen-yüan (late T'ang) totals more than 300. All have been destroyed.

By the T'ang dynasty, decorating temple walls with paintings had become almost a universal practice. Several hundred items are recorded in the *Li-tai Ming-hua Chi*: scenes of paradise and hell, images of Buddha, Bodhisattvas, lokapalas, demons, and other legendary beings. And these were from collections in the two capitals only—from Sian and Loyang (Honan). There were also many paintings by lesser artists in other cities and on the sacred mountains. Almost no works of this kind have been preserved in the central provinces, but the caves of Tunhwang on the Silk Road are a rich source of information on Buddhist mural painting in a frontier province.

By the beginning of the 8th century landscape, which was to become the noblest form of Chinese painting, had freed itself from its role as a mere background to figure painting. Li Ssü-hsün, who was born about 651 and died in 716 or 720, and his son, Li Chao-tao, are generally recognized as the liberators of landscape painting. Known as the Two Li Generals, they founded the Li or northern school of painting. The work of this school is characterized by careful, wirelike drawings colored with bright blue and green and accented with specks of gold and vermillion. It is highly decorative but somewhat stiff, with every detail minutely and laboriously depicted. While the Two Li Generals were perfecting this style, Wu Tao-tzu painted on the walls of the T'ang palace, in one day, in ink and only faintly tinted with colors, the panoramic *Three Hundred Li on the Chia-ling River*—a work widely different in technique and style from the products of the Li school.

About a half century later, the poet-painter

Wang Wei (699–759) was to be hailed as the master of ink landscape. His work, in contrast to the rigid draftsmanship of the Li school, is characterized by boldness and freedom. Wang Wei excelled in depicting mist and water and was the first to succeed in capturing atmosphere in nature. It is said of him that there are pictures in his poetry and poetry in his pictures. He, too, had his followers, and was hailed by Ming critics as the founder of the southern school of landscape painting, just as the Li Generals were called the founders of the northern school.

Among other great T'ang painters were Ts'ao Pa and Han Kan (fl. c.750), both celebrated for their pictures of horses, and Chou Fang and Chang Hsuan (late 8th century), who depicted domestic and feminine scenes. A copy of one of Chang's scrolls, made by Emperor Hui Tsung (r. 1101–1125) of the Sung dynasty, is in the Museum of Fine Arts, Boston.

Five Dynasties and Sung.—During the chaotic Five Dynasties period there flourished a number of artists who heralded the great Sung painters. Ching Hao, who lived at the end of T'ang and the beginning of this period, was the master of the great landscapist Kuan T'ung who exerted a tremendous influence on the landscape painting of the Sung dynasty. The monk Kuan-hsiu, who was active about 920, was famous for his figures, particularly lohans, which were to become a favorite subject of Sung painters. Hsu Hsi and Huang Ch'üan were painters of birds and flowers.

Mural painting, though less popular than it had been in the T'ang period, was still common during the Northern Sung dynasty, and a few Sung murals have escaped destruction and survived for posterity. In the Tunhwang caves are examples of the work done in a frontier province.

Working at the court academy under imperial patronage were such great painters as Kuo Hsi (c.1020–1090), the landscapist, and Huang Chü-ts'ai, son of Huang Ch'üan, who like his father painted birds and flowers but was a finer artist. Kuo Hsi's favorite subject was the snow scene, featuring bare trees with entwined branches. He is said to have originated the art of mural landscape modeling, in which the subject is worked out in relief in clay and then painted in color.

Among the scholar painters of the early Sung period, Li Ch'êng and Tung Yüan (late 10th century) are generally recognized as the greatest landscapists. Tung Yüan's scenes usually encompass a wide vista. His mountains, which are projected in soft, gentle brush strokes, are often interspersed with rugged, bony rocks, while the velvety, misty quality of a view may be accentuated with proud trees. A few of his masterpieces have been preserved, including a superb scroll in the Museum of Fine Arts, Boston. Another painter, Fan K'uan, often covered his hilltops with heavy vegetation, and placed high, rugged cliffs along riverbanks. Mi Fei (1051–1107) filled his scenes with heavy mists and clouds, and rendered his protruding hilltops with the horizontal, broad, short "eggplant" strokes so much imitated by later painters.

Li Lung-mien (Li Kung-lin, 1040–1106) is well known to the Western world. His line drawings of figures and horses, executed with extreme facility and dexterity, are examples of the highest achievement in draftsmanship.

Toward the end of the Northern Sung dynasty, Emperor Hui Tsung, himself an accomplished

artist who aimed at extreme naturalism, became a great patron of art. Nevertheless, though he devoted far more attention to the academy than had earlier emperors, it did not produce any outstanding artist.

While painting in general flourished in the Southern Sung dynasty, Buddhist painting receded into almost complete obscurity. By this time Buddhism had died out in the land of its origin. Confucian scholars launched merciless attacks on it, and the Buddhists themselves, now dominated by the Ch'an (Zen) sect, while not entirely iconoclastic, substituted meditation for image worship. Buddhist painters of this period preferred such themes as "Kuan-yin in White Dress by the Moonlit Pool," "Meditating Sages," or "Sixteen Lohans"—themes which were not bound by rigid rules calling for dignity and symmetry, as were the religious paintings of earlier periods.

In a world dominated by neo-Confucianism and Ch'an Buddhism, painters turned to landscape as their preferred medium of expression. In the late 12th and early 13th centuries the academy numbered a host of great landscape painters, including Liu Sung-nien, Liang K'ai (fl. c.1203), Hsia Kuei (fl. 1195-1224), and Ma Yüan (fl. c.1190-c.1225). Liu Sung-nien excelled in landscape of the blue-and-green (Li) style, and Liang K'ai was a master of the technique of line drawing of human figures against a landscape background, also in line. But the two great figures in ink landscape of the Southern Sung dynasty were Hsia Kuei and Ma Yüan. Hsia Kuei's strength and boldness are best seen in his famous *Ten Thousand Li of the Yangtze River*. Ma Yüan, who placed his horizons rather low, is more readily appreciated by Westerners. His landscapes, in contrast to those of Hsia Kuei, are marked by tranquility and delicate atmosphere, best illustrated by a pine tree silhouetted against a misty background, a motif familiar to every student of Chinese painting. Up to his time, Chinese landscape painters had tried to include all they saw. Ma Yüan's compositions show merely a few rocks and one or two trees. This pattern—simple in construction and sparse in detail—is perhaps closer to the Western conception of landscape painting than the all-inclusive pattern. It profoundly influenced the painting of the Yüan dynasty.

Yüan Painting.—The comparatively short Yüan period had a number of great painters. Chao Mêng-fu (1254-1322), best known as a painter of human figures and horses, was equally at home with landscape. He was also a calligrapher of the first rank. His best-known work is the *Horse with Groom*. Among the scholars who avoided Mongol officialdom was Ch'ien Hsüan (1235-c.1290), renowned as a painter of flowers, birds, and insects.

Wu Chên (1280-1354), Huang Kung-wang (1264-1354), Ni Tsan (1301-1374), and Wang Mêng (d. 1385) are honored as the Four Great Masters of Yüan. They were all landscape painters. Wu Chên treats his material somewhat heavily, but he has a keen sense of space. He is also well known for his bamboos. In striking contrast are the airy scenes of Huang Kung-wang and Ni Tsan, who used washes very sparingly, obtaining their effects with lines consisting mainly of dry brush strokes. This is particularly true of Ni Tsan, who emphasized this style through his choice of extremely simple

subjects. Wang Mêng painted his scenes heavily, building them up laboriously with individual strokes.

Painting of the Ming and Ch'ing Dynasties.

—The Ming dynasty, relatively recent, has left us many paintings. Mural painting became rare, but some examples which have come down to us, such as those in the Fa-hai Ssü, near Peking, show superlative craftsmanship. Yet connoisseurs and critics do not classify these murals as art, looking to the scrolls alone for the work of the great masters. Early Ming academicians strove to emulate T'ang and Sung paintings, but the spirit of their work is entirely different. Wu Wei, the landscape painter, who modeled himself on Ma Yüan, became the founder of the so-called Che (Chekiang) school. Pien Wên-chin (Pien Ching-chap, fl. c.1430) and Lü Chi (fl. c.1500) were well known for their flowers and birds in the manner of Huang Ch'üan and Huang Chü-ts'ai; Lin Liang founded a school in which the same subjects were treated in an extremely facile and sketchy manner. The leading exponent of the Che school is Tai Chin (Tai Wên-chin, fl. 1430-1450), originally an academician, but expelled from the academy through the intrigues of jealous colleagues. Like all painters of the period, he modeled himself upon Sung masters—specifically, on Ma Yüan—but created a style of his own, simple and articulate in stroke, light in rendering.

Both the academic and the Che schools gradually died out, the latter being reincarnated in the "literary man's style," best represented by the Four Masters of Ming: Shên Chou (1427-1509), T'ang Yin (1470-1523), Wên Cheng-ming, and Tung Ch'ü-ch'ang (1554-1636). Shên Chou is a master in treating a variety of subjects. His style is facile and ethereal. T'ang Yin excelled in both figures and landscapes. His figures are neither stereotypes nor graphic presentations of an ideal, but honest portrayals of life. Wên Cheng-ming painted landscapes with articulate brush strokes and light washes. Tung Ch'ü-ch'ang's landscapes enclose wide vistas and show a keen sense of space and atmosphere.

Ch'iu Ying (fl. 1522-1560), who learned his craft as a lacquer painter, was a master of detail. In his paintings we see the pleasures of everyday life exquisitely and faithfully recorded.

A salient characteristic of Ming painters is their masterly manipulation of the brush. It does not merely make a line or a wash; it conveys tone, strength, and spirit. In this dynasty the technique of the brush attained perfection.

Ch'ing dynasty art is a continuation of the Ming tradition. Early in this period the southern school of landscape painting, best represented by the four Wangs—Wang Shih-min (1592-1680), Wang Chien (1598-1677), Wang Hui (1632-1717), and Wang Yüan-ch'i (1642-1715)—came into prominence. Wang Shih-min and Wang Chien, who took Tung Yüan and Huang Kung-wang as their masters, formed the vanguard of Ch'ing painting. The former is known for his bold brush strokes. Wang Hui was a disciple of Wang Shih-min, and excelled him in control of the medium. He is said to have combined the northern and southern schools, and was proclaimed by his master as the Sage of Painting. Wang Yüan-ch'i, grandson of Wang Shih-min and the most learned of the four, best caught the spirit of Huang Kung-wang. He is known for his landscapes with light tinges of color.

Ch'ên Hung-shou (1599-1652) originated a style in which, despite an appearance of carelessness, each stroke is skillfully conceived and precisely executed. He had many imitators. Shih T'ao was another "careless" painter of landscapes and bamboos. Both men reached maturity in the Ming dynasty, but they lived into the early years of Ch'ing, and their influence on later painters places them as artists of the later rather than of the earlier dynasty.

SCULPTURE

Sculpture, like architecture, was not accorded due recognition by the Chinese. While we know something of the great painters, the sculptors are anonymous.

Early Sculpture.—The oldest specimens of Chinese sculpture were found in the Shang dynasty tombs at Anyang. The owl, tiger, and turtle are favorite motifs, and the human figure also appears occasionally. These marble pieces are in the round, some of them being architectural elements. Their surfaces are decorated with patterns like those found on the contemporary bronzes. In decorative pattern, in basic concepts of form and mass, and in spirit, the sculpture and the bronzes are one. Bronze masks have also been found, some of the *t'ao-t'ieh*, some of human beings. They are often well modeled.

Human figures and animals in the round began to be used as decorative motifs on the bronzes around 500 B.C. The human figures were first carved in the kneeling position, molded in strict conformity with the *law of frontality*, but the art soon freed itself to portray action. In general, the human figures are short and stubby, rendered with little feeling for modeling, but the animal forms show keen and subtle touches of the chisel, based on careful observation of nature.

Han; Three Kingdoms; Six Dynasties.—In the Han dynasty sculpture gained importance in conjunction with architecture. Reliefs decorate interior wall surfaces, such as those found in a number of tomb shrines, notably the tombs of the Wu family at Chiahsiang, Shantung. Human figures and animals (lions, lambs, and chimeras) in the round stand in pairs flanking the avenues leading to tombs, temples, and palaces. At Kufow (Chüfou), Shantung, the human figures are typically rigid, lumpy, and ill modeled, bearing only a vague resemblance to the human form. Yet the animals are in general well modeled, robust, vigorous, and animated. The lions and chimeras are usually winged. (Since figure sculpture, animal or human, had never been employed by the Chinese of earlier times as guardian monuments to an architectural approach, it is possible that the idea was imported from the Occident through contact with the barbarian tribes of the west and north.) On some of the contemporary *ch'üeh* in Szechwan are found reliefs of birds, dragons, and tigers that rank with the best decorative sculpture.

With the spread of Buddhism during the period of the Northern and Southern dynasties, anthropomorphic sculpture assumed an important role. A few small images of the early 5th century have come down to us. The first important monuments are in the caves of Yunkang, near Tatung, first capital of the Northern Wei dynasty (386-534 A.D.). These are undoubtedly Chinese versions of Buddhist caves in India. Yet, aside from decorative motifs (the acanthus leaf, the frets, the beads, and even the Ionic and

Corinthian capitals) and the basic conception of the caves themselves, there seems to be no traceable Indian influence to give the sculpture an Indian or otherwise un-Chinese character. There are a few characteristically Indian figures, but the group remains essentially Chinese.

The work on the caves near Tatung was begun by imperial order in 452 and stopped abruptly in 494, when the capital was moved south to Loyang. The plan of some of the caves is fairly similar to the chaitya caves of India, with the chaitya, or stupa, in the center. The architecture and sculpture, however, are basically Chinese. The earliest, and larger, figures, some measuring over 70 feet in height, are heavy and sturdy. The pleated draperies cling to the body. Later the figures grew more slender, and the head and neck became almost tubular. The eyebrows are arched and join with the bridge of the nose. The wide forehead is almost flat, turning sharply back at the temples. The eyes are mere slits; the lips, thin, forever smiling. The chin is often sharply pointed—a feature especially noticeable in some bronze statuettes of the period. The draperies no longer cling to the body, but hang from it, often flaring out at ankle level, and are arranged symmetrically on the right and left, with the pointed, almost knifelike, ends of the folds spread out like a bird's wings. (It is not by accident that pointed ends are also characteristic of the strokes of the calligraphy of the period.) The Bodhisattvas of these statuary groups, whose Indian counterparts wear princely attire, are stripped of most of their ornaments. They wear a simple tiara and a heart-shaped necklace, and from the shoulders of each figure hangs a long sash, the ends crossing through a ring hung in front of the thighs.

A project similar to that at Tatung was begun by the Wei emperors about 495 at Lungmen, near Loyang, on the cliffs of the I (Yi) River. Here the heads are less tubular and more rounded, and the draperies less pointed and more fluent, though still symmetrically arranged, achieving a superb decorative effect. The walls of some of the caves are decorated with reliefs representing the emperor on one wall and the empress on the opposite one, each attended by an entourage, forming compositions of the highest order. The activity of the cliff sculptors at Lungmen continued until the latter part of the 9th century.

When, in 534, the Northern Wei dynasty split into the Eastern (534-550) and Western (535-556) Wei dynasties, these new states were each soon usurped by powerful ministers, who founded the Northern Ch'i (550-577) and Northern Chou (557-581) dynasties. The Ch'i rulers were devout but extravagant Buddhists. Yet it was not until nearly the end of their brief dynasty, just before its overthrow by the rival Chou, that they began the caves at Tienlung Shan. Contemporary with these caves are those of Hsiang-tang Shan. Most of the figures of these caves assume a standing posture. Their heads are almost round. The forehead is markedly lower; the eyes, though still very narrow, are wider. The nose and lips are fuller, with the enchanting smile of earlier periods almost completely suppressed. The chin has become less pointed and often has a crescent-shaped groove suggesting a double chin. The draperies are simpler, hanging almost vertically with hardly any flare at the hem. In some specimens found in Szechwan, however, the clinging drapery still appears.

Sculpture of the Sui and T'ang Dynasties.

—In the Sui dynasty the standing figures begin to show a peculiar protrusion of the abdomen. The head has become smaller in proportion to the body, and the jaws and nose are fuller. The eyes, though still narrow, show some convexity in the upper lids, emphasizing the presence of the eyeballs. The slightly convex surface intersects the curved plane under the brow in a gentle "valley." The line of intersection appears as a wide arc, repeating the rhythm of the brow and the eye. The subdued smile is produced by more fully modeled lips, and the mouth is smaller. The neck has assumed the peculiar shape of a truncated cone, protruding sharply from the chest and joining the head with similar abruptness. The cone is circumscribed about halfway up by a groove-like fold. The drapery is shown in more natural folds, and the hem rarely flares. In contrast to the costume of Buddha, which is austere draped in all periods, that of the Bodhisattvas has become more gaudy. The tiara and the necklace are now bedecked with jewel-like ornaments. Strings of beads, hanging from the shoulders and interrupted at intervals with pendants, reach far below the knees.

Sculpture, especially Buddhist sculpture, reached its zenith in China in the T'ang dynasty. The work begun at Lungmen by the Wei Tatars attained new heights, and the creation of Buddhist images was advanced with similar zeal throughout the empire. About the end of the 9th century, however, cave sculpture seemed to lose the interest of the worshippers of central China. It was continued at Tunhwang, but the center for China Proper shifted to Szechwan, which contains many late T'ang caves. The activity in that province continued through the Sung and Yüan periods into the Ming dynasty.

It is difficult to differentiate sharply between the Sui and early T'ang styles, but toward the middle of the 7th century T'ang characteristics definitely emerged. The figures have become more naturalistic. The S-curve appears in most of the standing figures, which are balanced on one leg, with the hip of the relaxed leg and the shoulder on same side slightly lowered. To maintain equilibrium, the head is tilted slightly toward the side of the supporting leg. The body is more fleshy, although the waist remains slim. The face, especially that of the Bodhisattva, is pleasingly plump. The gracefully arched eyebrow is not carried quite so far as in the previous periods, but curves naturally, clearly defining the temple. The ridge of the eyebrow is now seldom incised with groove. The area of the upper eyelid extends farther up, and the curved plane below the brow is narrower. The nose is shorter and less sharply ridged. The lips are definitely sensuous, and the distance of the upper lip from the nose is markedly shortened. The hair is now carried very low, reducing the height of the forehead. The Bodhisattvas of this period are less garishly ornamented. The tiara is often simplified, but the hair is drawn into an enormous knot on top of the head. The garments are modeled to conform closely to the body, and the beads, though still often worn, are bare of most of their former pendants.

About the beginning of the 8th century a very earthly type of Buddha was introduced. He is represented as a complacent, fat creature of this world, with a flabby chin, scarcely any neck, and a full, protruding abdomen—a most unusual

conception of the ascetic who wandered the woods of Buddh Gaya. Not many figures of this type have been found, but all are evidence of superlative achievement in the plastic representation of the human form.

Toward the end of the T'ang dynasty, in the caves of the secluded Szechwan area, there appeared a type of sculpture characterized by the iconographic tributes and fantastic physiology of the newly popular *mi-tsung* or *mi-chiao* (secret sect or religion). In its treatment of the human form and of the draperies, however, it shows no perceptible break with T'ang tradition. An entire wall area is often used for a single subject. The paradise scene, which is pictured over and over again in the contemporary mural painting at Tunhwang, is here executed in relief, forming a single composition—a plastic conception never found in earlier cave sculpture.

T'ang sculptors were extremely skillful in portraying animal forms, many examples of which have been preserved in the grounds of the T'ang imperial tombs. Some smaller pieces are on view in museums of the United States and European countries.

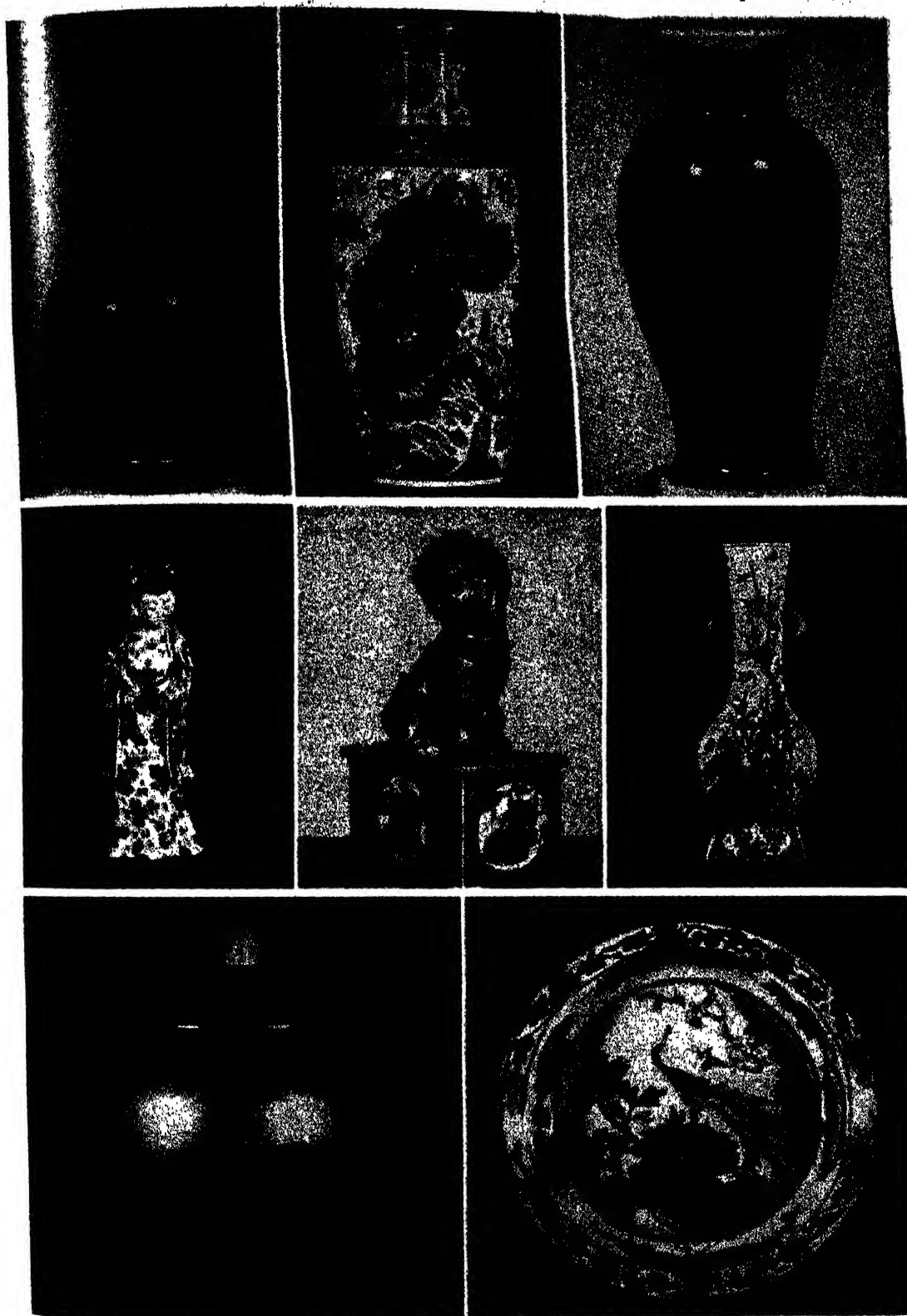
Sung Sculpture.—With the fall of the T'ang dynasty the creation of Buddhist images in stone almost ceased. Statues in Sung temples were carved in wood, modeled in clay, or, rarely, cast in bronze. The only exceptions are found in the caves of Szechwan. Few of the bronze images escaped melting down in later periods. One notable exception is the 70-foot statue of Kuan-yin in Chengting, Hopeh, cast by order of the first Sung emperor, T'ai-tsu (Chao K'uang-yin, r.960-976). Clay figures are numerous. A superb example of this work is the altar group in the Hua-yen Ssü, Tatung. The eleven-headed Kuan-yin of the Tu-lo Ssü Chihhsien, closely follows the T'ang tradition; it measures about 60 feet in height and is the largest clay figure in China. Many wooden statues of the Sung period have found their way to the museums of the West.

The most noticeable characteristic of Sung statues is the rounding of the face. The forehead is broader than in previous periods. The nose is short and almost bulbous. The eyebrows are less arched, and the convex surface above the upper lid is even wider, reducing to a narrow strip the concave plane under the eyebrow. The lips are thicker, and the mouth is very small. The smile has almost vanished. The neck is rendered naturally, emerging above the chest and supporting the head without any demarcation.

The S-curve of the T'ang bodhisattvas seems to have been forgotten. Even when the figure is not completely rigid, the ease with which T'ang figures carry their weight, and the consequent lowering of the relaxed side of the body, seem beyond the grasp of the Sung sculptors. The Ch'an Buddhists introduced a new pose for the Kuan-yin, showing the goddess seated on a rock with one leg hanging down and the other foot resting on the rock. This complicated pose presented the sculptor with new problems of arrangement of the body and the draperies.

Szechwan cave sculpture of the Southern Sung period shows evidence of a decline in the sculptor's art. This is especially noticeable in some of the Bodhisattvas. By this time they have taken on an unmistakably feminine appearance. They are gaudily dressed and overburdened with jewelry and ornaments. The pose is rigid, almost frigid; the expression is blank. The best

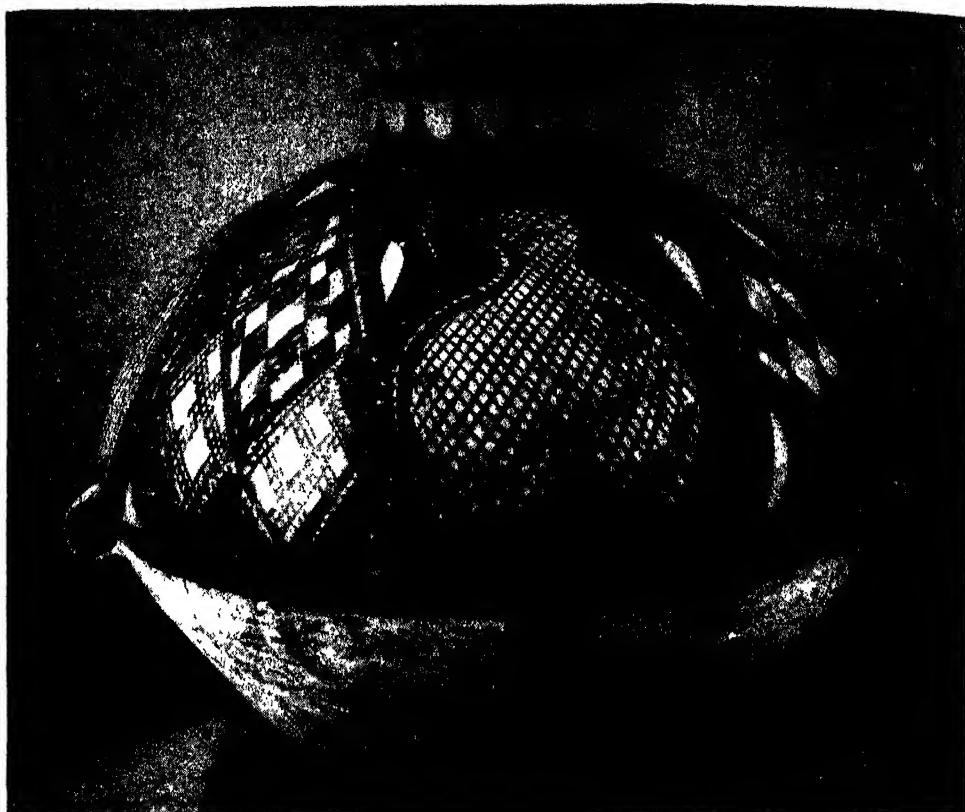
CHINA—CERAMICS



These porcelains belong to the K'ang-hsi period (1662-1722), with one exception. All are of the Ch'ing dynasty. Top row, left to right: vase; club shape vase; vase with ox-blood glaze. Center row: A delicate figure; lion with stand; rectangular vase with dragon handles. Bottom row: Bowl with tea-dust glaze (Yung-Ch'eng period, 1723-1735); a deep dish with peacock design.

Courtesy Museum of Fine Arts, Boston

CHINA—CERAMICS



Top: Large earthenware jar of the Yang-shao type. Prehistoric.



Left: Large, carved, white earthenware jug from Anyang. Shang dynasty (1523-1027 B.C.).

Bottom. Medium-sized, gray earthenware cord-marked *li*. Shang dynasty.

Courtesy (1) and (2) Smithsonian Institution, Freer Gallery of Art, (3) C. T. Loo



example of this work is the group of young, matriotlike Bodhisattvas in Tatsu.

Yüan, Ming, and Ch'ing Sculpture.—During the Yüan dynasty, Lamaist Buddhism was introduced from Tibet. With it came sculptors whose influence was to last through the Ming and Ch'ing periods. Most of their figures are shown sitting cross-legged. The waist is almost wasp-like, the chest is broad, and the shoulders are square. The head has become more squat, but the rhythm of the torso is repeated in the broadening of the forehead. The top of the head is flattened and surmounted by a grossly elongated *uṣṇiṣa*, the hump characteristic of the sculptured heads of Buddha.

The Ming and Ch'ing dynasties were a sad period for sculpture in China. The statuary of these periods shows neither the robust vigor of Han, nor the archaic charm of the Six Dynasties, nor the mature self-assurance of T'ang, nor even the rococo elegance of Sung. The sculptor's art had degenerated into uninspired manual labor.

LIANG SSU-CH'ENG,
Fellow, Academia Sinica.

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7. CERAMICS. Ceramic manufacture in China antedates the dawn of Chinese history, and articles of fired clay have been common in all periods of Chinese culture. The soil of every province of China abounds in shattered fragments, and ancient Chinese pottery found its way to many foreign lands. Korea has examples from the Han period and every succeeding dynasty of importance. In Japan, T'ang dynasty lead-glazed pottery offered to Buddha at the opening of the Tōdaiji at Nara in 752 A.D., is still preserved there in the Shōsōin. High-fired T'ang Yüeh ware was in use at Samarra in Mesopotamia between 838 and 883 A.D., and at about the same time, or soon after, in Egypt. Turkey was an early recipient of celadon and blue-and-white wares, some designed especially for Moslem use. Lung-ch'üan celadon of the Sung and Ming dynasties and blue-and-white ware are found through-

out the Philippines, in all of Indonesia, on the Malay Peninsula, and in India. More recently, China has supplied porcelain to her own people who have emigrated to the South Seas and all over the world. European and American imports of Chinese ceramics, with the possible exception of the Canton ware which was cleared commercially through Lowestoft, England, have depended largely on the sporadic and fickle demands of connoisseurship.

Guild System.—Chinese potters still ply their craft under group systems—family, village, or guild—which have insured amazing uniformity in wares for centuries. Undisturbed by the caprice of individual potters, these groups have been strongly influenced by inherited local traditions and by a continuous demand for wares meeting traditional standards. The art has always outshone the artist. Both the white porcelain (blanc de chine) of T'ehua, Fukien, and the blue-and-white ware of Chingtehchen (Kingtehchen; now Fouliang), Kiangsi, preserve a living tradition of 500 years. The famous green celadons of Chekiang and the brown-and-white *Ts'ü-chou* wares, despite some shifting of locality and a gradual decline in recent centuries, may each claim a history of at least 1,000 years. Certain names have come down to us, such as those of the Chang brothers of Lungch'üan and the Wang family of Changte, Honan, but these were master craftsmen associated with wares rather than with individual pieces. It is typical of the Chinese tradition that the names of some master potters who never signed a pot were perpetuated through posthumous deification.

Craftsmanship.—Chinese ceramic wares, all types of which are often loosely known as Chinese pottery, are classified by the Chinese themselves under three broad headings: *wa-ch'i* or earthenware, glazed or unglazed; *t'ao-ch'i* or stoneware, usually glazed; and *ts'ü-ch'i* or porcelain, glazed, resonant, and sometimes translucent. The Chinese have been unexcelled craftsmen in all three fields.

Simple coil and paddle methods, common in prehistoric times, have never been entirely discarded, while the potter's wheel associated with latter-day porcelain is of very early origin. Rapid turning was practiced long before the 1st millennium B.C., and clay slip in one or more layers was used from the earliest times. The Chinese embellished their wares by polishing (with an effect similar to the so-called glaze of Greek ceramics), painting, incising, comb marking, kneading, embossing, reticulating, glazing, crackling (or crazing), and enameling. Natural effects were admired and cleverly controlled. The use of molds, both patrices and matrices, and slip casting were common at various times. Saggers were often used in firing in the Sung dynasty and possibly much earlier. Indeed, there are few ceramic processes which have not been employed in China, and the influence of her potters' art has been felt throughout Asia and has had a tremendous effect on European ceramic products since the 15th century. Every piece of porcelain the world over is of Chinese ancestry.

Bricks and Tiles.—To the simplest category of ordinary earthenware belong the *chuan wa* (bricks and tiles or terra cotta) employed for centuries in Chinese building. A good example of their use is the Great Wall, a large part of which is constructed of huge gray bricks. Inscriptions appear on enough of these to show that

they have been used for building and repair for at least 2,000 years. Similar large bricks were normally used for the handsome, massive walls that still enclose most of the old cities of China. Plain gray clay tiles, heavy and durable, are the commonest roofing material in most parts of modern China, and their use can be traced back at least to the Chou dynasty, some extant examples bearing Chou-style ornament. Other architectural features frequently made of brick or tile are flooring, flagging, and the walls of buildings and courtyards.

From tomb walls of the Han dynasty and perhaps earlier come hollow, rectangular tiles up to six feet in length, typical examples of which have stamped or painted ornaments. The high-fired glazed roof tiles of the Yüan, Ming, and Ch'ing dynasties are famous. Yellow tiles were reserved for imperial usage or for buildings under imperial patronage, such as the roofs of the Forbidden Cities of Peking, Kaifeng, Nanking (no longer standing), and the Manchu capital, Shenyang (Mukden, formerly Fengtien), and for the outer surfaces of the "iron" pagoda at Kaifeng and the former so-called porcelain tower at Nanking. Other buildings—for example, the Temple of Heaven, Peking—have roofs of blue tile; still others, of green. Such roofs usually bear architectural ornaments of sacred, supernatural figures. Typical ornaments are pairs of fire-eating dragon-fish facing each other from the opposite ends of a ridgepole, representing opposing natural forces in proper balance. Tile work, in relief, in the aforementioned colors as well as in white, black, and occasionally purple, is found in the Ming dragon screens of Peking and Tatung, Shansi.

HISTORY AND DEVELOPMENT

Prehistoric Wares.—Unknown before the archaeological work begun in the 1920's, remains of many types of red, black, gray, and white earthenware have since been discovered in all parts of northern China from Chinghai to Manchuria. To Western scholars the most dramatic find is the *Yang-shao* pottery (with the related *P'an Shan* and *Ma-chang* groups), tentatively dated 3500–3000 B.C. Typical examples of this ware are the large buff or reddish burial jars and storage pots, made by coil and paddle and often rapidly turned (perhaps wheel-made), and painted in red and black with formal religious symbols, plus occasional naturalistic symbols such as cowrie shells. On some of the jar covers human heads are modeled. The *Yang-shao* wares compare favorably with similar neolithic pottery of Susa in Iran, Anau in Turkmenia, Tripolje (Tripolye, Komsomolye) southeast of Kiev, and the Indus Valley, and with the Pueblo pottery of the American Southwest.

Also of great importance are the black and gray groups, such as those found at Ch'eng-tzu Yai, near Tsinan, Shantung. These are related in some instances to the *Yang-shao* types, but more frequently than the latter exhibit recognizable Chinese bronze forms—for example, the hollow-legged tripods (*li*) and stem cups (*tou*). Corded paddle marks are typical, as are clay ribbon appliqué and high-polished black slip. Some of this remarkable polished ware is only one sixteenth of an inch thick—as thin as porcelain.

Scattered finds have also been made south of the Yangtze River. Notable among them are the polished black ware excavated at Liangchu, near Hangchow, and the gray wares paddle marked

with repeated square, lozenge, and *f*-shaped symbols, discovered on Lamma Island, near Hong Kong. These, like many of the northern finds, are evidence of continuity of manufacture from prehistoric times. Most of the wares, both north and south, have been found in association with artifacts of stone, bronze, and other materials.

Shang and Chou Wares (1523–256 B.C.).—The most distinctive pottery of the Shang dynasty is a kaolinic white earthenware ornamented with carved cicadas, dragons, *t'ao-t'ieh* (animal-like faces), and other figures, conveying profound concepts of life, death, and immortality in the same language of symbols and in the same style as the Shang ritual bronzes. Both these and cruder gray to reddish wares (carry-overs from prehistoric types) have been uncovered in excavations undertaken by the Chinese government at Anyang, site of the Shang capital.

Certain prehistoric wares, notably the black and gray, were probably made through the Shang dynasty into the Chou period. The latter dynasty saw the development of glazed earthenware, the glaze perhaps first appearing on the vessels through a natural process, from wood ash settling on the hot clay during firing. Before the end of the Chou period, as the heat of the firing was increased through development of the kilns and through the selection of natural clays with a high kaolin content, glazed stoneware came to be produced. The protoporcelain which the American anthropologist, Berthold Laufer, so daringly postulated in 1917 as a post-Han ware, may be recognized and accepted as of pre-Han origin.

Han Wares (202 B.C.–220 A.D.).—Best known of the Han wares, and originally common north of the Yangtze and also found in Korea, was a lead-glazed earthenware, the body of which fired either gray or red, with a glaze usually of dark, opaque green, patinating through burial to a light silvery hue. The shapes are sturdy and appropriate to an essentially heavy ware. The ornaments, typically molded in relief, include lively hunting scenes, with mountains, trees, clouds, dragons, tigers, bears, and mounted riders. Formal symbols are also found, particularly, as on the Han bronzes, the *t'ao-t'ieh* and ring, signifying the jaws of death and the way through them. Religious and secular purposes were served by such objects as grain jars, censers with hill-shaped covers (called *po-shan lu*), ladles, candlesticks, and, for funerary use, models of towers, farms, domestic animals, and people.

There are few examples in good condition of the originally common painted Han earthenware. For this reason, the tiles with swift brush drawings of Han men and women in costume, in the Museum of Fine Arts, Boston, are of paramount interest.

The protoporcelain which Laufer found to be rare in northern China is comparatively plentiful in the south. A kaolinic stoneware with a controlled ash glaze, it bespeaks a different background and another cultural environment. Typical ornament includes "herringbone" or zoomorphic handles, wavy comb markings, and incised, bird-headed clouds. A Han kiln site excavated by Olov R. T. Janse, Swedish American archaeologist, in Annam produced wares fitting closely the cultural pattern south of the Yangtze.

Han to T'ang (220–618 A.D.).—The indigenous custom of making funerary objects persisted in the four post-Han and pre-T'ang centuries. Clay figurines called *ming chi* were

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Above left: Medium-sized grave figure, a painted earthenware lady. Tang dynasty (618-906 A.D.).



Above right: Large grave figure of a glazed earthenware camel. Tang dynasty.



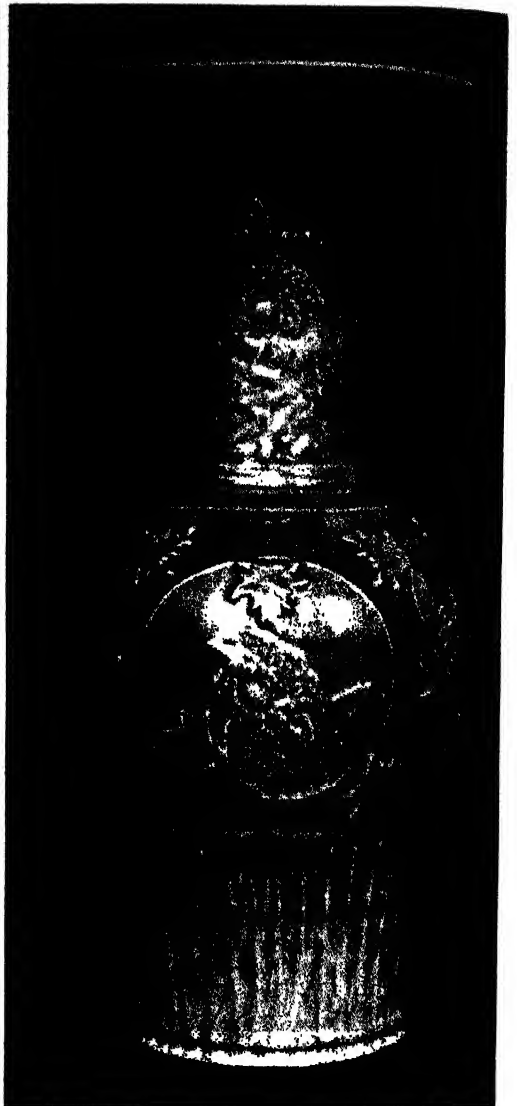
Right: Small stoneware pitcher, with a brown and streaked blue glaze. Tang dynasty.

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Courtesy William Rockhill Nelson Gallery of Art

Left: Large Tz'ü-chou porcelain vase, brown glaze on white. Sung dynasty (960-1279 A.D.).



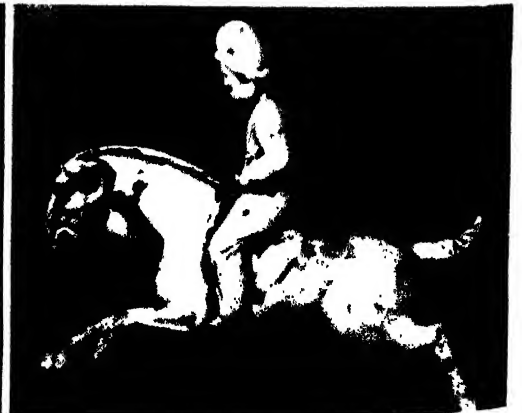
Courtesy Detroit Institute of Art

Right: Large Lung-ch'uan celadon vase. Sung dynasty.



Courtesy Dr. Sherman E. Lee

Left: A Tz'ü-chou pillow, painted brown and white. Sung dynasty (960-1279 A.D.).



Courtesy Detroit Institute of Art

Right: Grave figure, of white earthenware horse and rider. T'ang dynasty (618-906 A.D.).

simply and admirably modeled and decorated with slip and pigment, but not glazed. Representations of musicians, maidservants, soldiers, domestic and miraculous animals, and minor deities such as personifications of the signs of the zodiac, continued to be made for burial during this period, which also saw the development for aboveground use of an entirely different school of sculpture, in stone and bronze, devoted to Buddhist iconography (see section on *Art*). Constant in style but refreshingly different in their many types, these figures are generally assigned to the Six Dynasties, particularly to the Wei period (386–556 A.D.), an age of which we have scant knowledge apart from the figures, funerary and devotional, and the notable *Yüeh* ware.

Yüeh Ware.—Thanks to investigations made by Archibald Brankston, British authority, in 1937 at an inundated kiln site at Chiuyen, near Hangchow, we know that *Yüeh*—the first great porcelainous stoneware and first true celadon, one of the most important of China's ceramic wares—was already being manufactured close to the end of Han. Through *Yüeh*, an early ceramic culture spreading from Chekiang through Fukien and Kwangtung provinces to Lamma Island and Annam is linked to early Sung. Typical from the beginning are excellent wheel-thrown shapes and a transparent, thin green glaze in perfect bond with a compact, light gray body. The product of deeply religious folk, *Yüeh* ware is rich in symbolism, the earlier sacred frog, bear, lion, sheep, *tsao-p'ieh*, fish, and sun symbols losing favor to the dragon, phoenix, parrot, tortoise, duck, butterfly, and lotus in the T'ang and early Sung periods. Objects of all sorts were made, including winepots and teapots, cups, bowls, basins, censers, candlesticks, birdseed dishes, whistles, pillows, and even tombstones. Distinctive of successive periods are reel-repeat bands and molded appliqué ornaments, bird-headed spouts, square sockets for wooden handles, and swift, needle-fine engraving, sometimes combined with very low relief.

At the great kiln sites by Shanglin Hu (a lake near Yüiyao) are found all grades of *Yüeh* ware, from coarse to delicate, evidence of flourishing activity there during and after the T'ang dynasty. Potsherds dated 978 indicate continued operation under the Sung dynasty. Others marked *Nei*, or Inner (Palace), confirm, for certain pieces at least, reservation for imperial use. Known to connoisseurs as *pi-sê yao* (secret-color ware), many pieces warrant such early descriptions as "misty autumn green," "like ice," "like jade," and "like tender lotus leaves." Simpler *Yüeh*-like wares were also made near Foochow (Minhow) and Chengtu. *Yüeh* pottery, as we have noted, was widely exported. In addition, numbers of potters, emigrating to Korea, had a great influence on the celadon of that country.

T'ang Wares (618–906 A.D.).—South of the Yangtze the green *Yüeh* ware was paramount during the T'ang dynasty, although, according to the *Ch'a-ching* (*Book of Tea*), some tea drinkers preferred a white ware from Hsingchou, Chekiang. In addition, a highly porcelainous gray ware was produced near Chingtêchen (Fouliang).

Northern China was supplied with numerous wares which are not classifiable by site. Funerary figures of people, horses, camels, pigs, ducks, and guardians were usually lead-glazed in mixed colors: yellow, green and white, and, in a few cases, blue. More meticulously modeled and frequently more pretentious than the figures of Wei,

they are an indication of the prosperity of the era.

Jars, vases, and pots of this period exhibit as robust and noble shapes as ceramic art affords. Solid but neatly beveled bases, full bodies, narrow necks, firm mouths and rims, and well-made handles are typical. White and buff earthenware glazed like the grave figurines, and white and gray stoneware bearing either transparent, feldspathic neutral or greenish glaze, or opaque gray, white, black, and brown glaze, are characteristic.

In one type of ware the black or brown glaze is relieved by large milky blue splashes. In nearly all wares the body clay and glaze were generously used, and often the only ornament is the natural running of the glaze. Ornate medallion and appliqué pieces reflect the existence also of cosmopolitan and exotic taste. A marbled ware of brown and white clays, cleverly kneaded to produce different patterns and usually bearing a neutral transparent glaze, was also made. Buddhist emblems, particularly the lotus, were in constant use.

Wares of the Five Dynasties (907–960 A.D.).—During this period the most famous wares were *Yüeh* in the south and *Ch'ai* in the north, the former flourishing under the patronage of the Wu-Yüeh princes, the latter under a single emperor of the Later Chou dynasty, Shih Tsung (r. 954–959). Of *Ch'ai*, said to have been made at Chenghsien (formerly Chengchow) in Honan, little is known beyond the tantalizing description, "blue as the sky after rain."

Sung Wares (960–1279 A.D.).—Heirs to the soundest of pottery traditions and to all the secrets of the T'ang period, the master potters of the Sung dynasty developed a number of wares that have never been equaled. Their success depended on the exploitation of the natural properties of clay and the natural effects of firing, as well as on rare manual skill, an eye for subtle proportion, and sound knowledge of practical use and of sophisticated symbolism.

Despite the fame of the specific wares cited in the paragraphs which follow, hundreds of other wares are still unknown or unidentifiable. The general standards were so high that the mere designation of a pot as *Sung-tz'u* (Sung ceramics) is considered praise enough among potters.

Lung-ch'üan.—Celadon from Lungch'üan (Dragon Springs), southern Chekiang, gradually supplanted *Yüeh*. This *Lung-ch'üan* ware has a dark to light gray or white body and a glaze varying from many rich green and bluish green hues (*clair de lune*, sea green, and others) to extremes of gray and straw color. The glaze may be clear and transparent, with scattered bubbles, or dully translucent; it varies to the touch (an important consideration in Chinese use and connoisseurship) from smooth and glassy to unctuous ("like congealed lard"), and tends to run or gather attractively. Normally the specimens are heavy, with incised, carved, or appliqué ornament, and show a natural crackle or craze which darkens with age. Censers, large vases, plates, and rice bowls are most typical.

Two rare types of *Lung-ch'üan* attributed to the Chang brothers, *Ko* for the elder, and *Chang*, or *kinuta* (as the Japanese call it), for the younger, were intentionally cracked and smooth uncracked, respectively. Occasional brown-spotted *Lung-ch'üan* pieces are called by the Japanese term *tobi seiji*. The *Lung-ch'üan* body typically burns red when exposed—hence the term "iron foot" for unglazed bases.

"Northern Celadon" and *Ju*.—Similar to *Lung-ch'üan*, but perhaps more plebeian, is the ware known by the term "northern celadon," much of which is made in exquisite molds. It comes from Honan, which also produced the famous *Ju*, a much-disputed collector's item.

Kuan.—Two official celadons, both with controlled crackle, were northern *Kuan*, made at Kaifeng, of which there are few genuine specimens, and southern *Kuan*, made after 1135, when the Southern Sung capital was established in Hangchow. Kiln sites in that city reveal an unrivaled ware of astonishing thinness of body, thickness of glaze, and subtlety of potting, obviously catering to imperial taste. The body may be white but frequently is very dark; the glaze covers a wide range of soft grays, blue grays, and greens, and, rarely, straw color. Objects were sometimes ground down after biscuit firing and fired several times in order to increase the thickness of glaze and the size of crackle spacing.

Ting.—The famous white *Ting* ware made at Chientz'uts'un and Yenshants'un near Tingchow, Hopeh, exemplifies the usual practice of Sung potteries; it was produced in various grades from coarse to fine in order to meet different uses and different pocketbooks. The poorest peasant in Sung China could afford wares that are priceless today. *Pai Ting* is a creamy white translucent and resonant porcelain; *fên Ting* is grayer and sturdier; *T'u Ting* is frankly heavier, with a dark gray body dipped in white slip and a transparent glaze. The ware lent itself to the most delicate linear and comb-marked floral symbols, ducks, and reeds. Of the two kiln sites investigated by Fujio Koyama of Tokyo in 1941, Chientz'uts'un evidently produced the more sophisticated products, while Yenshants'un seems to have specialized in coarser wares. Besides the white ware, fine black and brown shards found by Koyama at the former site together with fragments of white-rimmed black bowls at the latter, have greatly expanded the general concept of the term *Ting*. These finds at once dramatically undermine the long-accepted Western term "Honan *temmoku*" and confirm Chinese tradition with respect to black *Ting* and red *Ting*.

The name *Ting* was associated with similar Kiangsi wares, nicknamed *nan* (southern) *Ting*. White and off-white porcelain types were found by Brankston near Chingtéchen (Fouliang) and at the Yungho site near Luling (formerly Kian or Chian). Much of the northern ware, especially *t'u Ting*, has been excavated at Chulühsien, a former market town on the Grand Canal, wiped out by a flood in 1108.

Tz'ü-chou.—Also recovered from Chulühsien were many examples of *Tz'ü-chou* (porcelain prefecture) ware, made at the nearby town of that name in Hopeh, in which white and brown to black slip and glaze were variously combined with white and buff body clays. Techniques include carving through one clay, light or dark, to reveal another, both being covered with transparent glaze. The underglaze brown painting—bamboo sprigs, vines, peonies, lotuses, birds, and animals—is akin to the brushwork of the great Sung painters. Storage jars, tall-necked vases, and pillows are well-known types of this ware. Occasional examples were covered with a transparent strong blue glaze. Rare though generally poor examples of late Sung to Yüan ware bear overglaze enamel painting in red, green, and yellow. The brown-and-white stock-in-trade ware

has been manufactured continuously down to modern times.

Chün.—From Chünchou (now Yuchow) came *Chün* ware in two grades, not always readily distinguishable: *ts'ü-t'ai* (porcelain body); and *sha-t'ai* (sandy or coarse body), the glaze of which is typically an opaque robin's-egg blue, plain or marked with crimson, pink, or strawberry splashes. Many other variations, including purple and gray green, are known in this glaze, which is usually thick, sometimes streaked, and may exhibit an "orange-peel" or "chicken-skin" texture on the surface, or equally admired "earthworm tracks"—vestiges of cracks in congealing immature glaze. Too garish for most Chinese, the ware is the pride of many a collector and the despair of many a potter who would copy it. Flowerpots numbered according to size, bulb bowls, censers, vases, and rice bowls are typical products.

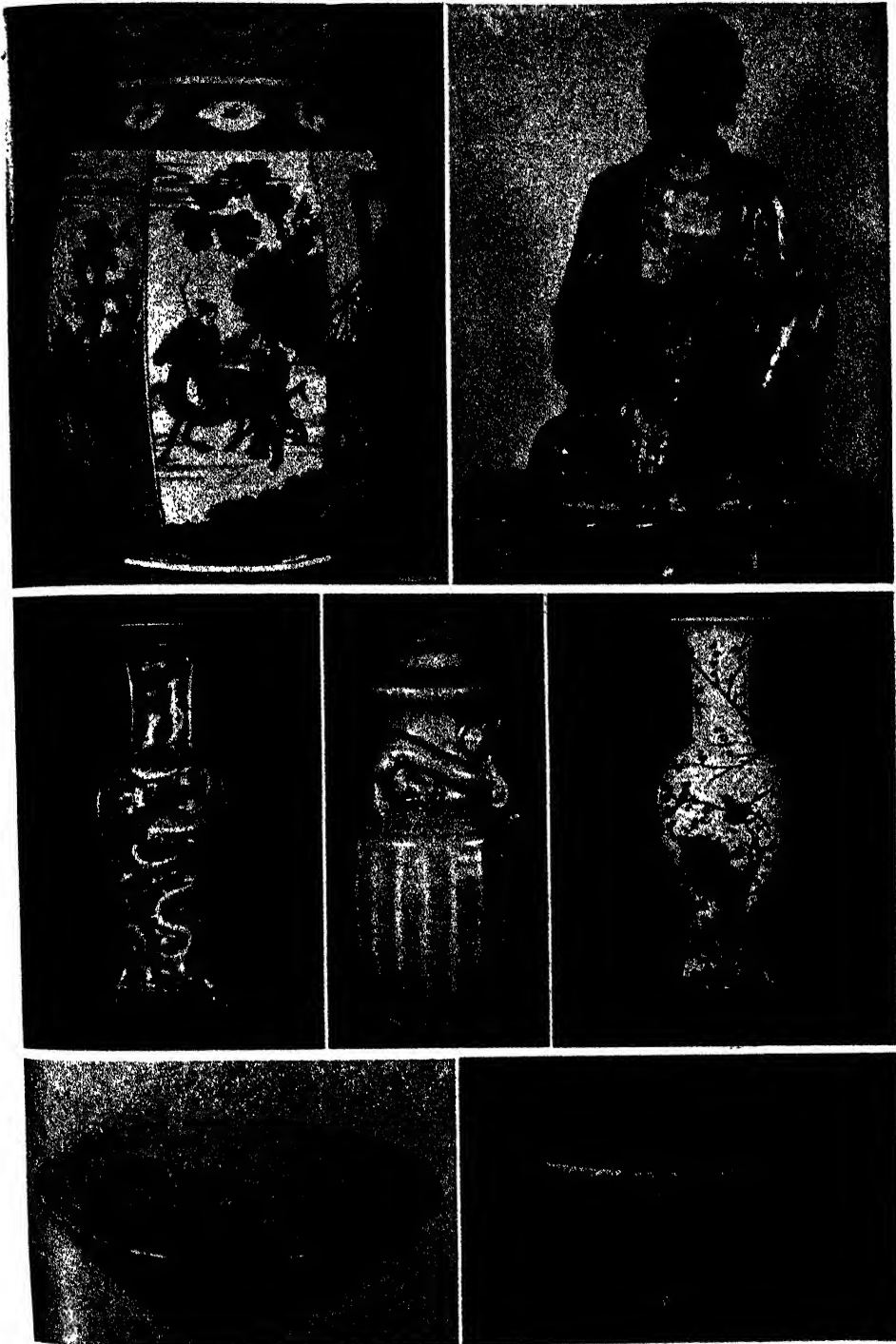
Ying-ch'ing.—In the Chingtéchen area the *ying-ch'ing* (shadowy blue) porcelain was made like *Ting* in thinness and ornament, but with a more granular body and a glassier glaze. Both freehand and molded ornament were employed, as in *Ting*, for bowls and saucers, often silver rimmed, and for many other objects. The color range includes gray and white.

Chien.—One of the wares most renowned among the tea drinkers of China and Japan, and one of the humblest, was *Chien*. This ware is known also by the Japanese name *temmoku*, through association with a single bowl brought to Japan from the sacred Buddhist mountain, Tienmu Shan, in Chekiang. It was made near the village of Shuichi in northern Fukien. Manufactured in tea-growing hills, it was a simple local product that found favor and fame abroad. It has a porous gray to black body and a glaze that may be plain black or brown, or may show streaked effects over black, called "hare's fur," "partridge feather," or "oil spot," gathering in a thick welt or "tear drops" short of the base. Even in Sung it was imitated at the Yungho kilns near Luling, where ornament was added by brush, leaf, or stencil. Kiangsi *temmoku* is the name of this brown-glazed white-bodied ware. "Northern *temmoku*" is the accepted Western term for various black and brown wares of Honan and Hopeh, in which white and buff bodies and painted ornament (brown over black), and "oil-spot" effects are usual. Heavy specimens are sometimes attributed to *Tz'ü-chou*; lighter plain examples have been identified as red and black *Ting*.

Yüan Wares (1260-1368 A.D.).—The invasion of the Mongols and establishment of the Yüan dynasty had little effect on the potter's art in China, and most of the Sung wares continued in production. The *shu-fu* palace ware, a faintly bluish white porcelain, was made only in Yüan. Of importance to ceramics outside of China was a visit of King Rama Kamheng of Siam (now Thailand) to Kublai Khan, the first Mongol occupant of the Dragon Throne. One of the results of this visit was the emigration of several hundred potters to Siam. Informal excavations at Savargalok (Sawankhalok) and Sukhodaya (Sukhothai) show obvious Chinese influence, particularly in the celadons. See also THAILAND.

Ming Wares (1368-1644 A.D.).—Under the patronage of the Ming emperors the long-maturing porcelain tradition received tremendous impetus. With inexhaustible supplies of the essential elements for porcelain manufacture—kaolin (China clay), and petuntse (China stone)—at hand, a

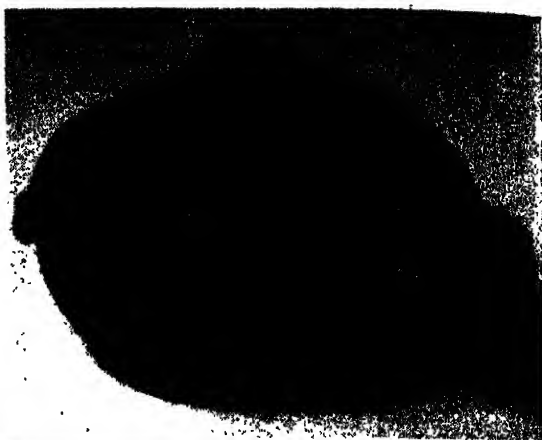
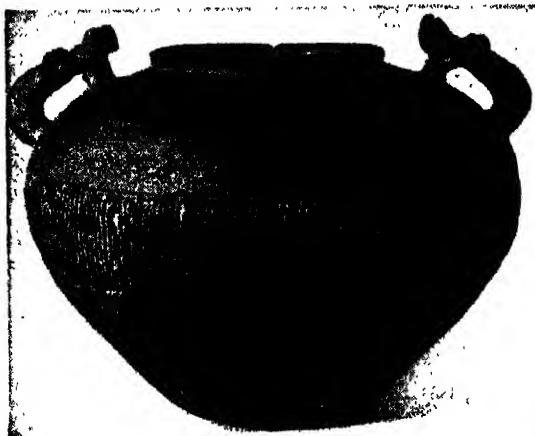
HINA—CERAMICS



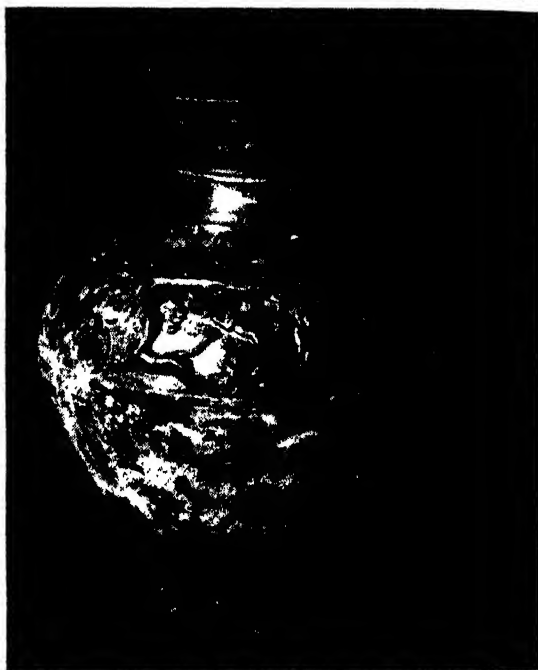
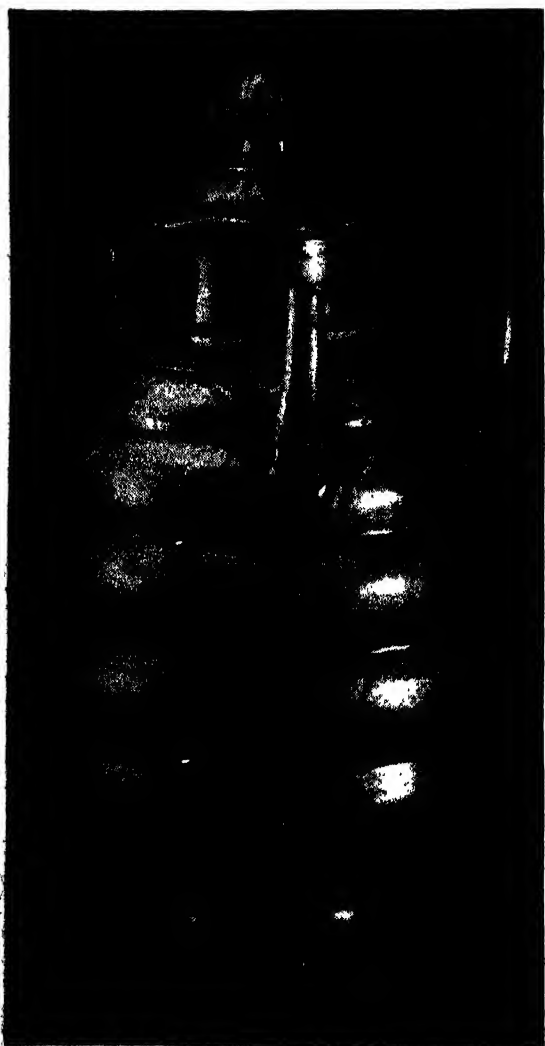
Top row, left to right: Porcelain famille verte egg-shell lantern (K'ang-hsi period, 1662-1722); pottery statuette of an artist or disciple of Buddha (T'ang dynasty, 618-907). Center row: Decorated green dragon vase (K'ang-hsi period); pottery vase with cover, celadon type (Sung dynasty, 960-1280); porcelain famille verte palace vase with red hawthorn blossoms (K'ang-hsi period). Bottom row: Pottery tea bowl of Honan Temmoku ware (Sung dynasty); pottery celadon bowl, Ko type.

Courtesy Museum of Fine Arts, Boston

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Top left: Large protoporcelain jar. Chou dynasty (1027-256 B.C.). Top right: Early Yüeh frog pot, about four inches in height. Third-fifth centuries A.D. Right: Large, green glazed, earthenware pot. Han dynasty (202 B.C.-220 A.D.).



Left: Large Yüeh Buddhist ritual jar. T'ang dynasty (618-906 A.D.). Bottom: Small Yüeh sherd from Shang-lin Hu T'ang dynasty.

Courtesy (2) Mrs. Walter Seagewick, (3) and (5) James M. Plumer



with a slow awing in popular taste to white porcelain, the wares of Ching-t'chen and lesser sites soon overshadowed the finest Sung wares. Unfortunately, the rejection of gray clays eliminated one of the important visual effects of so many of the Sung wares, that of toning down the color of the glazes over them. What some ancient and modern authorities might hold to be impurities in the dark clays of Sung (for example, presence of iron in *Lung-ch'üan* and *Chien*) were often the source of the color of the glaze itself. "Purification" of the body and glaze left white wares that could be developed as white monochromes, or as white wares decorated by adding color.

Some Sung wares continued to flourish, notably the solid, durable celadon made at Lungch'üan and, as time went on, at other places in the district. A number of examples which can be identified as Yüan, Ming, or even Ch'ing are nevertheless in the direct Sung tradition. Many others have careless or novel shapes, whiter bodies, and thinner, weaker greens, and fall away from the old standards. Often conscious reconstructions of Sung types were made, with effects such as that obtained by simulating in brushwork the natural "iron foot" of Sung.

T'z'u-chou ware had a history similar to that of *Lung-ch'üan*. The tradition lived on, although old secrets were sometimes forgotten in following new trends. The ornament tended to become more meticulous, so that both the slapdash boldness and the finesse of the earlier ornaments and shapes were too often lost. Some excellent embellishment in two or more shades of brown is found in *T'z'u-chou* Yüan and Ming ware dynasties.

Ming White Wares.—White monochrome porcelains, mentioned by such travelers as the Arab Ibn-Batuta (q.v., traveled 1325-1349), have been manufactured in one place or another continuously into the 20th century. A collection of white wares alone would be of great interest and variety. Rarest and finest of the Ming white wares was that made for imperial use during the Yung-lo period (1403-1424), and known because of its thinness as *t'o-t'ai* (bodiless) or "eggshell" porcelain. Unless the object is held to the light, the decoration is unnoticeable.

Also famous in Ming times, and remarkable for its continuation with little or no change, is the white *Tê-hua* made in the village of that name. Known alternatively as *Hinghua* (after Hsinghua) ware and (white) *Chien* ware (not to be confused with Sung *Chien*), it became very popular with early European collectors. Many of the finest specimens, known as *blanc de chine*, are found in France. In addition to all sorts of household utensils and scholars' desk pieces such as brush holders, the ware is famous for admirably modeled figures. These include Buddhist images of Kuan-yin (Goddess of Mercy), Kuan Lao-yeh (God of War), and Mi-lo-fo (Maitreya), and Taoist images of the *pa hsien* (Eight Immortals), all in sizes to fit household shrines. Temple paraphernalia was also made—three-legged incense burners, vases in the shape of the sacred double gourd, and traditional decorative objects, such as imitation rhinoceros-horn cups ornamented with plum blossoms. These items are of a smooth, milky or ivory white, thin or thick, heavy or delicate, solid or hollow according to requirement, but always of high-grade porcelain.

Ming Blue-and-White Wares.—Blue-and-white porcelain, which was known in the Yüan period probably as early as Sung, in time rivaled,

and finally overtook, celadon as the standard household ware throughout China. Special interest was shown by the Ming emperors, who, one after another beginning with the Hung-wu reign (1368-1398), patronized Ching-t'chen. Specimens attributed to this first reign must be accepted with reserve, but collectors are on safer ground with respect to the famous blue and whites of the Yung-lo (1403-1424), Hsuan-tê (1426-1435), Ch'eng-hua (1465-1487), Hung-chih (1488-1505), and later reigns.

The blue employed for underglaze decoration is cobalt oxide, a mineral that must be ground to a fine powder and mixed with water before application with the brush. A small amount goes a long way, and painting on the thirsty clay body requires speed and control. The Yung-lo blues are very dark ("deep kingfisher" to smoky black), with a tendency to drift attractively like wisps of smoke into the clear glaze. This blue was undoubtedly the *su-ni-p'o ch'ing* (Mohammedan blue) said to have been imported from Iran. Careful firing is essential. The clear, deep quality of the Hsuan-tê blues set a standard for later periods. The native color, dull gray blue to blue black—not without an appeal of its own—is easy to distinguish. It is found in all the blue-and-white wares of the Wan-li reign (1573-1620) and of other times when foreign imports were cut off.

The ornament in blue and white is always more detailed and elaborate and often more labored than that of Sung wares, but it has the same, never-failing symbolic purpose. Flowers, vines, fish, legendary scenes, and (on the imperial pieces) five-clawed dragons abound.

Canton and Ching-t'chen were the chief of many centers of manufacture of blue-and-white ware. Malcolm Farley, American missionary and archaeologist, found evidence of it, surprisingly, at Têhua in 1935.

Ming Yellow Ware.—Imperial Ming yellow of the Hsuan-tê, Ch'eng-hua, Cheng-tê (1506-1521), and Chia-ching (1522-1566) reign periods is the most famous of the Ming monochromes. It is a white porcelain to which a coat of yellow glaze was applied over a colorless glaze before firing, with the underside left white, and bearing in Mohammedan blue the reign name enclosed in a double circle. The yellow, near lemon but never greenish, is the symbolic color of the Son of Heaven, the color of the sun, the source of life-giving power brought down to earth in the person of the emperor.

Other Ming Monochromes.—Comparatively rare, these include black, copper red and iron red, cobalt blue, aubergine, and apple green. The last named was used over a cracked glaze.

Ming Polychromes.—*San-ts'ai* (three color) is the name given to handsome, heavy pots decorated in low-fired glazes laid on rather crudely in areas outlined in threads of clay. The technique is like that used in cloisonné. This is the Ming development of the Han-T'ang lead-glaze tradition. Green, yellow, aubergine, dark blue, turquoise, and transparent (for white) are the colors employed, often more than three at once.

Wu-ts'ai (five color) is an elastic term for many-colored enameled wares too numerous to describe in detail. As the Ming dynasty advanced, the potters tended to develop more and more mixtures and arrangements of colors, including gold, and more and more clever technical devices, so that the resulting objects call to mind a flower garden, a piece of embroidery, or a

in cloisonné, obliterating all suggestion of the potter's art, which is always there underneath. Even the most gaudy specimens, however, are documents of a superb and flourishing culture. The elements of the aesthetically dazzling ornaments are always meaningful symbols.

Earthenware.—Earthenware objects for garden, desk, tea table, and nursery were manufactured from the 16th century on at Ihsing (Yih-sing), in Kiangsu, and Fashan (Fatshan or Namhoi), near Canton. The significance of these wares, glazed sparingly if at all, is that they thrived in the heyday of brilliant glazes, relying for their color appeal on the polished surfaces of common black, brown, and yellow clays.

Ch'ing Wares (1644–1912 A.D.).—The Manchus, succeeding a native dynasty, followed the splendid precedent of the Mongols in maintaining the cultural traditions of the country they had conquered. Almost every ceramic ware of Ming had a successor, and nearly every ware of Sung was copied. It was a prolific era, in which craftsmen became increasingly involved in mass production and catered to a rising popular demand for curiosities. Modern potters rightly marvel at the technical achievements of Ch'ing. This was the age which produced, with equal virtuosity, tiny snuff bottles and porcelain vases large enough to hold a man.

Certain remarkable developments were encouraged by imperial patronage, particularly during the three great reigns of K'ang-hsi (1662–1722), Yung-ch'eng (1723–1735) and Ch'ien-lung (1736–1796). From the K'ang-hsi period come the finest oxblood or "crushed ruby red" *Lang-yao* and the related peach bloom, as well as apple green, mirror black, and many other monochromes. Ordinary ginger jars, decorated with well-drawn *Prunus* blossoms against a crudely painted, solid cobalt background, brought ridiculous prices in the West. Other curious fads of the 18th and 19th century European collectors were the clumsy and gaudy vases grouped under their predominating color: *famille verte*, *famille rose*, and *famille noire*. Chinese and Japanese collectors, enjoying color in smaller amounts, have preferred "tea-dust" glaze, in as many subtle hues as the flavors of the tea leaf.

In the painted ornament of household wares, in which blue and white predominate, is found, in addition to the familiar decorative symbols, a mine of folklore material. Pretty scenes and popular tales veil a wealth of metaphysical content. In the so-called love-chase pattern, for example, in which the huntsman, riding with his beloved on one horse and shooting downward, slays a rabbit, two symbols of the flesh are involved. The lower symbol (the rabbit standing for carnality) is destroyed through the hunter's aim and through the balance maintained in the higher symbol (the horse standing for the flesh as vehicle).

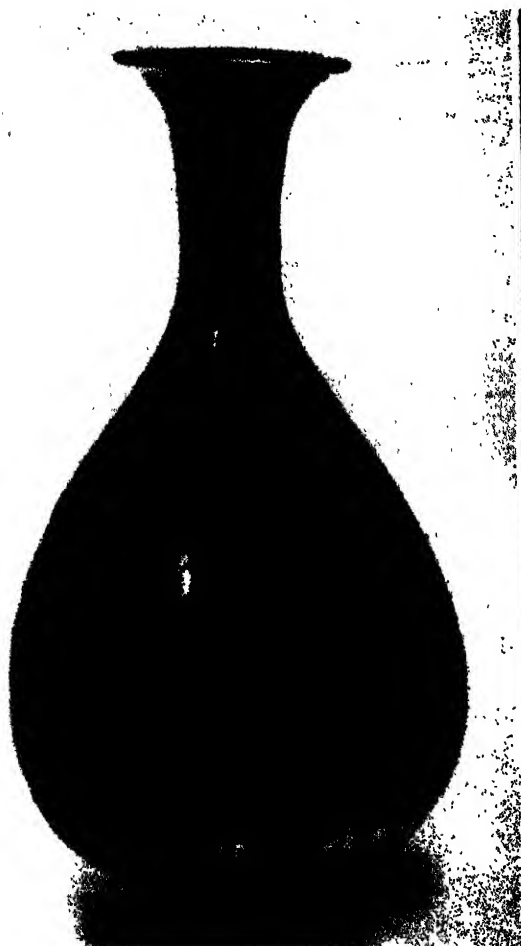
Modern Wares.—In modern China, ceramic wares of all kinds are made in every province, with Fouliang (Ching-t'chen) still holding the leadership. Obtainable in the open market are temple images and censers, toys and desk ornaments, vases, wine jars, pillows, deep oval Soochow (Wuhsien) bathtubs, fertilizer cisterns, cups, bowls, soup spoons, and fish plates—all evidence that Chinese ceramic traditions are still very much alive.

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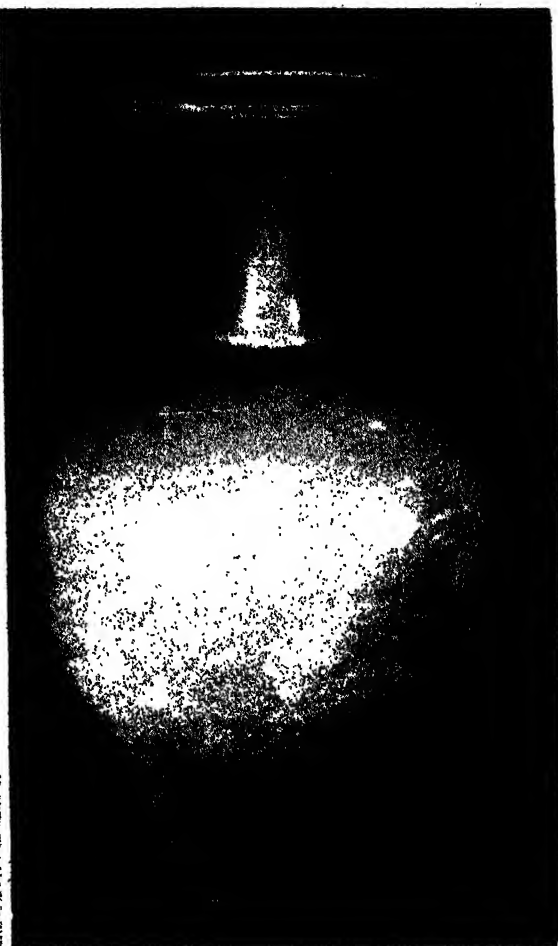
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JAMES MARSHALL PLUMER,
Associate Professor of Far Eastern Art, University of Michigan.

CHINA—CERAMICS



Top left: "Northern temmoku" flask of brown and iridescent, in a medium size. Sung dynasty (960-1279 A.D.).



Top right: Large Tü Ting vase. Sung dynasty.

Right: A Pai Ting winepot of medium size. Sung dynasty.

Bottom: A Tz'ü-chou pillow in sgraffito brown and white. Sung dynasty.

(Top left) The Fogg Museum of Art, Harvard University; (top right) Charles B. Hoyt; (right) Francis Diechowsky; (bottom) The Cleveland Museum of Art



CHINA—CERAMICS



Left: Large blue and white porcelain vase with imperial dragon design. Ming dynasty, Hsüan-té reign (1426-1435). Top right: Small blue and white winepot, found in Philippine Islands. Ming dynasty (1368-1644). Center right: Small Yüeh sherd from Shanglin Hu. T'ang dynasty (618-906 A.D.).

(Left) William Rockhill Nelson Gallery of Art, Atkins Museum of Fine Arts, Kansas City, Missouri; (top right) Museum of Anthropology, University of Michigan; (center right) James M. Plumer



Lower left: A Chün flowerpot, blue streaked with red. Sung dynasty (960-1279 A.D.). Right: "Northern celadon" bowl, small in size. Sung dynasty.

(Lower left) The Fogg Museum of Art, Harvard University; (right) Buffalo Museum of Science



CHINA, Great Wall of, the largest artificial defense structure in the world, a barrier extending for about 1,250 miles (with its branches, about 2,000 miles) in northern China Proper, of which it forms in part the boundary. Its western end is in the deserts of Central Asia; its eastern end reaches the sea northeast of Peking. There is also an extension to the Sungari River to the northeast. The wall was erected as a barrier against the inroads of barbarian tribes, and a portion of it dates from about 214 B.C., during the Ch'in dynasty. The greater part, however, was built in the latter half of the 14th century, during the Yuan dynasty. The wall is carried over height and hollow, without regard to topography, and in one place is at a height of more than 5,000 feet above sea level. Earth, gravel, brick and stone were used in its construction; some parts are more substantially built than others. Its greatest height, including the parapet at the top, is about 50 feet; the average height is about 22 feet, and the width 20 feet. It is strengthened at regular intervals by 40-foot towers. See also *CHINA—History*; *CERAMICS*.

CHINA CLAY or KAOLIN. See *KAOLIN*.

CHINA GRASS. See *RAMIE*.

CHINA INK. See *INDIA INK*.

CHINA ROSE, *Rosa chinensis*, the name given to a number of varieties of garden rose chiefly derived from *Rosa Indica* and *Rosa semperflorens*, both natives of China; it is also called Bengal rose. The name is also given to *Hibiscus rosa-sinensis*, a mallow common in China and Indonesia, and an ornament in greenhouses.

CHINA SEA, that part of the Pacific Ocean bordering the coasts of China, French Indochina, and Malaya, from southernmost Japan to the end of the Malay Peninsula. Formosa and its strait divide it into a northern part, the East China Sea (or Eastern Sea), and a southern, the South China Sea. The term "China Sea," however, is often restricted to the area of the South China Sea. The East China Sea, smaller of the two parts, is enclosed on the north by the Yellow Sea and Korea; east, by Kyushu and the Ryukyu Islands; south, by the southern Ryukyus and Formosa; west, by China. The northern limits of the South China Sea are formed by China's Kwangtung Province and Formosa; eastern, by the Philippine Islands; southern, by Borneo; and western, by the Malay Peninsula and Indochina.

CHINA-UNITED STATES DIPLOMATIC RELATIONS. There is an old story, long discredited, that a Chinese Buddhist priest discovered North America in the 5th century of the Christian era. So far as is known no Chinese set foot in the New World until long after the Columbian discovery. Sino-American relations virtually started when the Spanish and Portuguese began introducing American plants, American minted dollars, and even the *morbus americanus* (syphilis), to all parts of the world.

On the Atlantic coast of North America interest in China was hardly reflected until the 18th century when *chinoiserie*, an echo of the fads which were sweeping over Europe, began to touch a few homes. Of all Chinese products tea was most in demand, imported to the British

colonies in British ships. After the famous Tea Act of 1773 and the Revolutionary War, American merchants, prevented from trading with the British West Indies, were forced to seek their fortunes farther afield, and set out directly for the East.

The first American ship to reach China (on Aug. 28, 1784) was the *Empress of China*, loaded chiefly with ginseng. It made the round trip from New York to Canton in 15 months. Its return cargo, mainly tea, made a profit of 25 per cent. This successful venture prompted other shipowners in Salem, Boston, Providence, New York, Philadelphia, and Baltimore to enter the China trade. The supercargo of the *Empress*, Samuel Shaw, was appointed first American consul at Canton in 1786 to watch over this trade, and continued in office, without salary, until his death in 1794. His position was not recognized by the Manchu government, but it tolerated his presence and threw less difficulties in his way than did the British, who slighted him on his second voyage. The Chinese people, a few of whom were acquainted with the main facts of the American Revolution, first called the United States the New Nation, changed later to *Hua ch'i kuo* (Flowery Flag Nation) after the stars of the new emblem.

During the early decades, the American traders were confined, like all other Occidentals then coming by sea, to the single port of Canton, and were bound by certain regulations. They obeyed the rules fairly well, although like the rest they indulged in the illicit trade in opium, picked up as a cash cargo en route to China. In 1821 an American called Terranova, in the good ship *Emily*, which was known to be engaged in smuggling opium, was accused of accidentally killing a Chinese woman. The Manchu government demanded that he be turned over to the local court of justice, and the Americans yielded, although they were sharply criticized for so doing by the British.

By 1839 troubles over opium smuggling and other matters had reached such a pitch that war between the British and the Manchus was inevitable. Although the United States took no part in this affair, American businessmen gained much from the privileges wrung in 1842 by the British through the Treaty of Nanking. By this treaty Canton and four other ports—Amoy, Foochow (now Minhow), Ningpo (now Ninghsien), and Shanghai—were opened to trade and residence (including missionary activity), consuls were permitted to establish offices at all five places, a low tariff on all imports and exports was promised (this was an encroachment on China's sovereignty), and a measure of extraterritoriality stipulated (another encroachment).

Two years later the newly appointed United States commissioner to China, Caleb Cushing, negotiated the Treaty of Wanghia (ratified by both Manchu and United States governments in 1845). He had endeavored to undertake the negotiations at Peking, the capital, but was prevented from doing so by the insistence of the Manchu commissioner. His treaty—of 34 articles as compared with Sir Henry Pottinger's 13—provided for the same privileges and concessions as the British, together with four significant additions: Americans engaging in opium smuggling would receive no protection from the United States; revision of the treaty would be permitted at the end of 12 years; officers and citizens of

the United States would have the right to purchase books and to employ Chinese scholars for the study of the languages of the empire; and the article on extraterritorial jurisdiction was more definitely stated.

It read in part as follows: "... and citizens of the United States who may commit any crime in China shall be subject to be tried and punished by the Consul, or other public functionary of the United States, thereto authorized, according to the laws of the United States." Cushing also inserted a joker in the treaty, the so-called favored nation clause, which read: "And if additional advantages or privileges, of whatever description, be conceded by China to any other nation, the United States, and the citizens thereof, shall be entitled thereupon to a complete, equal, and impartial participation in the same." In the Chinese text he called the North American continent *A-mei-li-chia kuo*, generally shortened to *Mei kuo* (beautiful country), a name which has stuck.

Within 12 years (1856) the United States looked to Peking for a revision of the treaty but attempts to communicate with the Manchu court were rebuffed. The British, smarting from various slights, joined by the French, made an appeal to arms, and forced their way first into Canton (1856) and then into Tientsin (1858). The Americans did not join in the fighting, but took advantage of the situation to negotiate a revision of the American treaty at the same time that the British, French, and Russians were negotiating theirs. Exchange of ratifications was arranged for the following year (1859), John Elliott Ward being sent by President James Buchanan for the purpose. The British and French were blocked because they insisted on going their own way to Peking. The Russians had no difficulty as they went overland, while Ward followed the instructions of the government and was borne in state to the capital. As he refused to kowtow to the emperor, he was obliged to return to Pehtang (Peitang) for the ratifications. This treaty provided for the opening of more ports to trade and residence, the right of direct correspondence with the imperial government, and the right of missionaries to practice and teach religion. It also contained this clause, subsequently to be recalled by the Chinese, particularly in 1919 at Paris:

"If any other nation should act unjustly or oppressively, the United States will exert their good offices, on being informed of the case, to bring about an amicable arrangement of the question, thus showing their friendly feelings." Americans were to share, through the favored nation clause, in the provisions later obtained by the British and French: namely, the establishment of permanent diplomatic residences in Peking, the creation by China of a foreign office which would treat with foreign nations on terms of equality, and the right to travel freely in the interior of China. An indemnity of \$735,000 for American losses sustained in the war between China and Great Britain was likewise obtained; more than half of this sum was returned by Congress in 1885 after all claims had been examined and met.

In the meanwhile the Protestant churches in the United States had become interested in China as a sphere of activity, and this interest was to exert a marked effect on American governmental policy. The churches in this respect were fol-

lowing the lead of the London Missionary Society (Congregational), which sent its first missionary, Robert Morrison, to China in 1807. As a matter of fact, the British East India Company would not let Morrison travel on its ships; so he was obliged to sail to the United States and seek passage on an American clipper; he reached Canton armed with a letter from Secretary of State James Madison, addressed to United States Consul Edward Carrington.

The first American missionary body was the American Board of Commissioners for Foreign Missions, an interdenominational organization with headquarters in Boston, which later was maintained by the Congregationalists alone as other denominations formed their own societies. Its first missionary to China, sent at the instance and partly under the support of an earnest and substantial American merchant in Canton (D. W. C. Olyphant), was Elijah C. Bridgman, who arrived in 1830. An excellent student of the language and culture of China, he started and edited *The Chinese Repository*, an invaluable record of the early years of Sino-American relations. Among able successors to him were S. Wells Williams, printer, scholar, diplomat, and first professor of Chinese at Yale, who arrived at Canton in 1833; and Peter Parker, physician, interpreter, and the commissioner of the United States (to punish the recalcitrant Manchu court, he tried to occupy Formosa for the United States, but Congress would have none of it), who arrived in 1834 and opened the first missionary hospital in 1835. These and many other missionaries became a large fraction of the United States citizenry in China. (In the 1870's a census showed 500 Americans, of whom 200 were missionaries.) They had the most intimate dealings with the Chinese, learned their language best, and were in the forefront in efforts to evangelize them, and provide them with both the material and nonmaterial benefits of American culture. Similarly their writings and lectures about China and the Chinese were for a century the principal source of information to the people of their own homeland. Toward the end of the 19th century a few Americans were scattered among the Roman Catholic societies (founded in Europe) working in China, but not until World War I dried up the usual sources of funds was an American Catholic society founded to send out missionaries direct.

Among the men of adventure from the United States who have gone to China, first place should possibly go to Frederick T. Ward (1831-1862), a native of Salem, Mass. After an inconspicuous life as a sailor in and out of Shanghai from 1851 to 1859, he was arrested by the United States consul in Shanghai for violating the neutrality of the United States by offering to aid the imperial army fighting the Taiping rebels. He broke away and for the next three years organized, drilled, and led a motley body of troops against the rebels in the neighborhood of Shanghai. So successful was he that the Manchus made him a colonel, the British and United States governments came to his support, and on his death posthumous honors were granted by the court and a library was erected in his memory at Salem.

The first United States minister to reside in Peking was Anson Burlingame. He liked Chinese, sympathized with the government, aided it in its problems. In 1867, when Mr.

(later Sir) Robert Hart of the British Inspectorate General of the Customs proposed that a mission be sent abroad to negotiate more favorable treaties and to arrange for legations in Western capitals. Burlingame agreed to be chief of the mission. Assisted by one Manchu and one Chinese, the mission visited the United States, Great Britain, France, Germany, and Russia, but broke up on the premature death of its leader in St. Petersburg in 1870. It had been greeted with some skepticism, but undoubtedly brought about useful results. In Washington, Burlingame negotiated a new treaty, the principal articles of which recognized China's right to regulate her own internal trade, provided for the opening of consulates in the United States, recognized the "right of man to change his home and allegiance" and "the mutual advantages of free migration and immigration," and declared that "Chinese subjects visiting or residing in the United States shall enjoy the same privileges, immunities and exemptions in respect to travel or residence as may be enjoyed by the citizens or subjects of the most favored nation."

For the United States it was standard practice to recognize the inherent right of man to change his home and allegiance. For China the reverse was true; for centuries the people of China had been forbidden to go abroad. Hardly had this treaty been signed (1868) when agitation against Chinese immigration to the United States began. In 1870 there were 62,376 Chinese, mostly laborers, in the United States. They began to come at the time of the California gold rush and later were employed in large gangs in the construction of transcontinental railway lines. As long as there was a labor shortage all went well; when construction ceased, the Chinese were legislated against, mobbed, and maltreated. A congressional commission reported on the situation in 1877, and Congress passed a bill forbidding their immigration in 1879. President Rutherford B. Hayes properly vetoed this as violating the Burlingame treaty.

James B. Angell, president of the University of Michigan, was then asked to go to Peking to arrange if possible for a modification of the treaty. In this he was successful, the Manchu court agreeing "that the Government of the United States may regulate, limit, or suspend such coming or residence, but may not absolutely prohibit it." Congress in 1882 then suspended the immigration for 10 years. By this time there were about 105,000 Chinese in the country and the leaders of the anti-Chinese agitation clamored against the legislation. The question became a political football until about the turn of the century, when the exclusion of Chinese, except for temporary residence by certain classes, was enacted. The Chinese were deeply offended by this act, as were the friends of China. Actually, however, the removal of the question from the political arena, the cessation of the stump speeches and scurrilous attacks of all sorts, made life for the Chinese in the United States more bearable again. Nevertheless their number dwindled until in 1940 only 37,242 were recorded. By this time the gallantry of the Chinese people in their fight for freedom and the genuine esteem of millions of Americans for their qualities of frugality, orderliness, and hard work resulted in a new attitude. On Dec. 17, 1943 the exclusion laws were repealed, immigration was put on a quota basis, and Chinese became eligible for naturalization.

By the last decade of the 19th century events in eastern Asia seemed to be rushing inexorably toward a partition of China. Japan won an easy victory in the war of 1894-1895, demonstrating China's defenselessness. Russia, France, Germany, Great Britain, and Japan moved in for the kill. With the annexation of the Philippine Islands the interest of the United States in developments across the Pacific mounted. To ensure American participation in the markets of a China free from entanglements, the United States government—historically insistent on having the same rights in China as any other nation—proposed (1899) to the powers the policy of the Open Door. Though the proposal met with a chilling response, Secretary of State John Hay announced that from henceforth all were agreed on equality of opportunity and the maintenance of the territorial integrity and autonomy of China. Even as the United States prepared to join in the anti-Boxer expedition in the summer of 1900, Hay declared that the American objective was "to seek a solution which may bring about permanent safety and peace to China, preserve Chinese territorial and administrative entity, protect all rights guaranteed to friendly powers by treaty and international law, and safeguard for the world the principle of equal and impartial trade with all parts of the Chinese Empire."

In the next year the United States, represented by William W. Rockhill—one of the best-trained men ever sent to China by the United States Department of State—participated in the peace negotiations which followed the Boxer outbreak. Rockhill, always striving for clemency, succeeded in whittling down the punitive measures for which others strove (even so, they were excessive), and in preserving the imperial government for a few more years. One important byproduct was that in 1908 and again in 1924 the United States government, acting on the suggestion of Dr. Arthur H. Smith, a missionary, and following the precedent set in 1885, decided to return the undistributed part of the indemnity. The money was used by the Chinese for the education of their youth, many of whom were sent to the United States for advanced study. This enlightened step was generally followed later by the other governments concerned, though different uses were made of their funds.

After the establishment in 1912 of the Chinese Republic which the United States recognized in 1913, the United States government looked sympathetically on the republic's efforts toward reconstruction. As soon as the United States was assured of the genuineness of Japan's Twenty-one Demands (1915), it joined with Great Britain in protests to Japan, a move which resulted in the withdrawal of the most objectionable demands. At the peace conference in Paris in 1919, President Woodrow Wilson sympathized with China's demand that Japan be prevented from continuing its hold on the former German possessions in Shantung, but gave in to Japan's insistence in the face of Japan's support by the other powers, and his far greater desire to see his creation, the League of Nations, brought into being. Later, at the Washington Conference of 1921-1922, this was corrected, and the Nine-Power Treaty drawn up at that time bound its signatories to respect the sovereignty and independence and the territorial and administrative integrity of China, and to support the principle of the Open Door in China.

For a decade it looked as if China had been well started on the road to health and strength, without interference from its neighbors. There was a burst of interest, in the United States and elsewhere, in the upbuilding of its commerce, communications, currency, law codes, opium suppression, sanitation, education, and the like, in which both the United States government and private individuals, companies, and institutions (notably missionary bodies and the Rockefeller Foundation) took part. That decade ended suddenly on Sept. 18, 1931 with Japan's invasion of Manchuria. Secretary of State Henry L. Stimson proposed to the League of Nations that it apply sanctions against Japan, and promised American support. The Council of the League was unwilling, however. Whereupon, Stimson proclaimed in identical notes to China and Japan that the United States refused to recognize any situation or agreement which was contrary to its own announced policy of the Open Door, and which impaired the provisions of the Nine-Power Treaty. This had no effect on the ruling group in Japan, which continued its program of territorial aggrandizement as it saw fit. Until 1941 the United States government endeavored to be as correct as possible in its dealings with Japan, in the face of a rising tide of resentment among American citizens against the acts of the Japanese military on the continent. These relations came to an end on Dec. 7, 1941 with the outbreak of war. To the end of hostilities the United States was an active ally of China. In 1946, with American soldiers and marines largely withdrawn from the China theater, United States Ambassador Gen. George C. Marshall, and many others, both civilian and military, were seeking to be of assistance in hastening China's recovery.

Their efforts proved fruitless, however, and General Marshall left Nanking early in 1947 convinced that the Nationalists and Communists were making no genuine efforts at rapprochement. During the shooting war which developed, the Nationalists, largely supplied with United States equipment and officered by some United States-trained men, gained initial successes. By the end of 1948, however, demoralization set in; much of the equipment passed into the hands of the enemy; and all resistance on the continent faded in the winter of 1949. The Nationalists in their redoubt on Formosa hoped for more direct American aid, but this was denied them until, in June 1950, the United States ordered the Seventh Fleet to patrol Formosa Strait, stationed an air force unit on the island, and subsequently appointed a military and naval attaché and sent an army commission to Formosa to survey Nationalist China's most pressing defense needs. The United States government also strengthened its diplomatic ties with the Nationalists by directing (July 28) a minister to head its legation on the island. Meanwhile, it continued the Economic Cooperation Administration (ECA) program of economic assistance to Formosa, and in May provided additional funds for scholarship aid to Chinese students and scholars in the United States. The possibility that the People's Republic of China would be recognized instead was made improbable early in 1950, when the Communists mistreated United States consular and military officers and confiscated part of the one-time embassy compound in Peking; it was made out of the question when, in November, the Communist Chinese Army attacked United Na-

tions forces in Korea, and the chief of the Communist delegation to the United Nations, invited to argue their case with respect to Formosa, launched into bitter diatribes against the United States government and made impossible demands upon it. The United States consequently had no official representatives on the Chinese mainland, but a dwindling number of American citizens continued their educational, medical, and evangelistic activities.

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L. CARRINGTON GOODRICH,
Professor of Chinese, Columbia University.

CHINABERRY or **WILD CHINA TREE**, a common name for the soapberry tree (*Sapindus marginatus*). It is a handsome tree, sometimes growing as high as 60 feet. The flowers are white, and the oval berries are very saponaceous. It grows from Florida westward to Arizona and northern Mexico, and in southern Kansas. The wood is very hard and heavy, weighing nearly 60 pounds to the cubic foot. The name chinaberry is also given to the China tree, *Melia azedarach*, a native tree of India, also called pride of India. It is extensively cultivated in warm countries as a shade tree.

CHINANDEGA, chē-nān-dā'gā, Nicaragua, capital of the department of the same name, situated 26 miles northwest of León, and 13 miles from the port of Corinto on the Pacific Ocean, with which and with Managua it is connected by rail. It is the center of trade for the surrounding rich agricultural area, and it has a large sugar refinery. Pop. (est. 1943) 15,525.

CHINCH BUG (*Blissus leucopterus*), the popular name of a fetid insect of the family Lygaeidae, resembling the bedbug. It is very destructive to wheat, corn, and other crops of the southern and western parts of the United States. The name is also applied to the bedbug (*Cimex lectularius*).

CHINCHA, chēn'chā, **ISLANDS**, a group of small islands off the coast of Peru, situated at latitude 13°38'S. and longitude 76°28'W. They are granitic, arid, and destitute of vegetation, and their coasts are difficult of access. They formerly contained large deposits of guano.

CHINCHILLA, chīn-chīl'ā, a genus of South American herbivorous rodents (*Chinchilla laniger*) allied to the cavies, which they resemble in the general shape of the body, in the length of

the hind legs, in the conformation of the rootless molars, and in the nature of the fur, which is rather woolly than silky. The chinchilla is about 10 inches long, with a tail of equal length, and is covered with a beautiful pearl gray fur of high commercial value. It lives gregariously in the Andes of Peru, Bolivia, and Chile, and makes numerous and deep burrows. It is gentle and playful and loses none of its liveliness in captivity. In the United States chinchillas are raised commercially. The genus gives its name to the family Chinchillidae, which contains two other genera: *Lagidium chinchilla*, a large chinchilla-like rodent of the Andes; and the viscacha (*Lagostomus maximus*), a burrower found in large numbers in the Argentine pampas. The chinchilla derives its name from the Quechua word *sinchi* (strong).

CHINCHON, chên-chôn', CONDE DE. See CARRERA BOBADILLA CERDA Y MENDOZA, LUIS GERÓNIMO FERNANDEZ DE.

CHINCHON, Spain, a town 25 miles southeast of Madrid. Peruvian bark was named chinchona (later changed to cinchona) after Condesa Ana de Chinchón, wife of the viceroy of Peru, in 1638.

CHINDE, chîn'dě, town, Mozambique, on the only navigable mouth of the Zambezi River. It was at one time the chief port for Northern Rhodesia and Nyasaland, but was superseded by Beira, which has good rail connections. Pop. (1940) 1,442.

CHINDWIN, chîn'dwîn', river in the Sagaing division of Upper Burma. The chief tributary of the Irrawaddy, it has a length of approximately 550 miles and is navigable for 350 miles. The largest town on the river is Monywa, which is connected by rail with Mandalay.

CHINESE ARROWROOT. See NÉLUMBO.

CHINESE BIRDS' NESTS. See BIRDS, NESTS OF.

CHINESE CHIPPENDALE. See CHIPENDALE FURNITURE.

CHINESE GORDON. See GORDON, CHARLES GEORGE.

CHINESE HEMP. See CORCHORUS.

CHINESE LACQUERWORK. See LACQUERS AND LACQUERWORK.

CHINESE LANTERN, a collapsible lantern made of thin paper, usually patterned in various colors, and used for decorative (both door and outdoor) illumination.

CHINESE TURKESTAN or **CHINESE ATARY**. See SINKIANG.

CHINESE WAX. See WAX.

CHINESE WHITE, a pigment prepared from the white oxide of zinc (ZnO), introduced into the arts in the late 18th century as a substitute for preparations of white lead. Its color is changed by exposure to air. Though not so

heavy in body as white lead, when mixed with water colors, it renders them less transparent.

CH'ING, ch'ing (MANCHU), the last Chinese imperial dynasty, succeeding the Ming in 1644 A.D., and ending in 1912 with the establishment of the republic. Peking, captured by Chinese-Manchu forces from a rebel army in 1644, displaced Mukden (Shenyang) as the chief Manchu administrative center.

CHINGFORD, ch'ing'fêrd, England, municipal borough in Essex, situated 12 miles northeast of London and just southwest of Epping Forest. It is part of Greater London. Pop. (1951) 48,330.

CHINGHAI, ch'ing'hi', or **KOKO NOR** (Blue Sea), second in size of China's provinces, has an area of about 257,655 square miles. Formerly part of Nearer Tibet, it became a province in 1928. It is named after Koko Nor, the largest of the Chinese salt lakes, which is situated in the northeastern part of the province. This lake, over 65 miles long and almost 40 miles wide, is fed by 72 rivers, large and small. The headwaters of China's two largest rivers, the Yangtze and the Hwang Ho (Yellow River), are in Chinghai. Branches of the Kunlun Shan cross the province, which is on a plateau. Chinghai is known for its magnificent scenery and for the colorful Lamaist temples which accentuate its landscape. Agriculture is very limited, and animal husbandry is the main source of livelihood. In addition to rich deposits of gold and coal, Chinghai has some iron. The gold is mined by the primitive method of panning. To develop the province, the national government built a small power plant in Sining, the capital. There are no railroads, but there is a road system of more than 1,000 miles, constructed during the Sino-Japanese War of 1937-1945. Pop. est. 1,200,000.

CHINGLEPUT, ch'ing'g'l-pōōt, town, India, in Madras Province, 36 miles southwest of the city of Madras, situated in a valley surrounded by hills. It has Roman Catholic and Protestant missions, a hospital, and the ruins of a fortress captured by the British in 1752. Pop. (1941) 17,829.

CHINHAI, chîn'hi', city, China, in Chekiang Province, about 12 miles from Ninghsien (Ningpo), on Hangchow Bay. It did not become a treaty port and developed no foreign commerce of its own; instead, it serves as a transshipment point for trade with the Chu Shan Archipelago. Pop. (est. 1948) 13,987.

CHINHSIEN, jîn'shyên' (CHINCHOW), city, China, in Liaoning Province, Manchuria, connected by rail with Tientsin and Mukden (Shenyang). It is an active trading center and has a population (est. 1942) of 142,606.

CHINIOT, chîn'i-ût, town, Pakistan, in the Punjab, 80 miles west of Lahore. It is known for its wood carving and has manufactures of coarse cloth. It has a considerable trade in wheat, cotton, and other agricultural products. Pop. (1941) 34,437.

CHINKIANG, chîn'kyäng', city, China, in Kiangsu Province. The city is on the Yangtze

River at its junction with the Grand Canal, 40 miles east of Nanking. The city is situated on a plain with hills rising in the distance on three sides. Its name means "guard the river," an indication of its military importance for many centuries. The history of Chinkiang goes back about 2,000 years. In the 5th century A.D. important irrigation works and canal building were undertaken in this area to improve agricultural production and increase trade. Marco Polo tells of the town and of the establishment of Nestorian Christian churches there, a fact confirmed by a Chinese record of about 1333.

In 1842, during the Opium War, it was taken by a British fleet after determined resistance by the Manchu garrison. Later the Taiping rebels seized and held it from 1853 to 1857, leaving the city a ruin. The city, together with its river port, was officially opened to foreign trade by the Treaty of Tientsin (1858), and after its rebuilding, business grew for a time. Construction early in the 20th century of the Shanghai-Nanking and Tientsin-Pukow railways diminished its importance, particularly in respect to foreign trade. But Chinkiang flourished anew when (1928-1949) it succeeded Nanking as capital of Kiangsu Province. It was separated from Tantu County in 1949 to become an independent municipality. Pop. (1948) 179,059.

CHINLING SHAN or **TSINLING MOUNTAINS**, chin'ling'shān', China, a range running east and west, chiefly in central Shensi Province. It is part of the mountain barrier dividing the agricultural regions of northern and southern China. Its highest peak rises to about 12,000 feet.

CHINNERETH, Sea of. See **GALILEE**, SEA OF.

CHINO, chē'nō, city, California, in San Bernardino County, about 30 miles east of Los Angeles, on the Southern Pacific railroad. It is situated at an altitude of 730 feet. Chino is the center of a rich agricultural area, producing citrus and other fruits, walnuts, potatoes, beans, sugar beets, grain, and dairy products. Thoroughbred horses, cattle, sheep, and hogs are raised in the vicinity, and there is a state game bird farm nearby. The city is the site of the Casa Colina Home for Crippled Children and the California Institution for Men, a state honor prison. There is a modern community building. The Chino Unified School District serves both the city and its trading area. Founded in 1887, the city was incorporated in 1910. It is governed by a mayor and council. Pop. (1950) 5,784.

CHINON, shē-nōn', town, France, in the Department of Indre-et-Loire, situated on the Vienne River, 18 miles east-southeast of Saumur. Crowning a lofty rock are the ruins of an old castle which once belonged to the Plantagenets; here Henry II of England died in 1189. It was later the residence of several French sovereigns, and here, in 1429, Joan of Arc revealed her mission to Charles VII. A farmhouse across the Vienne in La Devinière is pointed out as the birthplace of François Rabelais. Pop. (1946) 4,312.

CHINOOK, shī-nōōk' (from *Tsinúk*, the Chehalis Indian name for this tribe), the most

important and best-known tribe of the Chinookan linguistic family of North American Indians. They were first described by Meriwether Lewis and William Clark in 1805. At that time the Chinook numbered about 400, living in several small villages on the north side of the Columbia River from its mouth to Grays Bay and north along the Pacific coast to the northern shore of Willapa Bay in the present state of Washington. Their houses were large plank structures, each occupied by three or more families. They lived primarily upon fish, wild roots, and berries. Commonly traveling by water in large dugout canoes they made extensive trading journeys. Their language formed the principal basis for the Chinook Jargon, a trade language employed by both Indians and whites along the Pacific slope from California to Alaska. The custom of artificially flattening the skulls of infants by frontooccipital pressure was common among them; hence they were often referred to as Flatheads. In the mid-19th century the Chinook proper became mixed with the Salishan-speaking Chehalis and lost their tribal identity.

Many small tribes speaking languages closely related to that of the Chinook proper lived on the lower Columbia River west of The Dalles at the beginning of the 19th century, and collectively comprised the Chinookan linguistic family. Lewis and Clark estimated the total population of these tribes at 16,000 in 1805. In 1829 an epidemic destroyed four fifths of the Indians in this region. The survivors continued to decrease in numbers and merged with tribes speaking other languages. Chinookan linguistic family is now represented by the remnants of a few tribes living on the Warm Springs Reservation in Oregon, on the Quinault Reservation in Washington, and scattered through their former habitat along the lower Columbia River.

JOHN C. EWERS,
Division of Ethnology, United States National Museum.

CHINOOK SALMON or **QUINNAT SALMON**. See **SALMON**—*Pacific Salmon*.

CHINOOK WIND, the name of two winds of the northwestern United States. The first is a warm, moist, southwest wind which occurs along the coasts of Oregon and Washington. The second is a warm, dry wind which blows from the Rocky Mountains over the plains that stretch from their eastern base. The moisture-laden winds from the Pacific Ocean striking the lofty barriers of the Cascades and the Rockies are forced to precipitate their moisture as rain and snow. When the ranges are crossed, the winds are cold and dry. Descending the eastern slopes of the mountains, they become warmer because the air is condensed, the atmospheric pressure at the base of the mountains being much greater than at the summit. The winds are still dry, however, since all their moisture was precipitated in crossing the mountains. In the descent of 10,000 feet or so to the plains of Montana and the Prairie Provinces of Canada, the winds have come so warmed by the increased pressure that they give a mild climate to regions far north. It is because of these winds that cattle on the prairies of Alberta can graze in the fields all winter, a snowfall of a foot or more disappearing in a few hours before the warm, dry breath of the Chinook. Not all the warm winds of Mo

tana and the regions north and south have their origin west of the Rockies. Various causes contribute to the formation of descending air, and when the descent is a number of thousands of feet, the winds resulting are always warm. Such winds blow over prairie regions west of the Missouri, but not always adjacent to the Rockies. Similar warm winds are known in other parts of the world, as in Switzerland, where they are called foehn winds.

CHINQUAPIN. See CHESTNUT.

CHINS, a tribe of eastern Bengal, Assam, and Burma. See KUKI-CHINS.

CHINTZ, chints (Hindu *chint*, spotted, variegated), a cotton cloth printed with gay designs of flowers and other patterns, usually in several colors. The name was originally applied to a stained or painted cloth made in India. The chintzes of the Coromandel Coast of India were celebrated in the time of Marco Polo, in the 13th century. They are mentioned also by Duarte Barbosa, a Portuguese who visited India soon after Vasco da Gama rounded the Cape of Good Hope in 1497. They were a favorite in the time of Queen Anne of England, early in the 18th century, long before cotton prints became inexpensive. Chintzes are made in many popular priced varieties and are extensively used in home decoration, particularly for curtains, drapes, and slip covers.

CHINWANGTAO or **CH'IN-HUANG-TAO**, chin'hwäng'dou', city, China, in northeast Honch Province near the Great Wall, on the Gulf of Po Hai. On the Tientsin-Mukden Railroad, it is a major commercial port, being ice-free during the winter. Opened in 1901 as a treaty port, it ships coal from Kaiping, in the Kailan mining district, besides glass, cement, and peanuts. After World War II, the United States Navy and Marine Corps maintained a base and airport there until the civil war of 1947 caused the evacuation of all American forces. Pop. (1947 est.) 100,000.

CHIOCOCCA, kī-ō-kōk'ā, a genus of four or five species of tropical plants in Central America and South America of the madder family Rubiaceae with opposite leaves, clusters of yellowish flowers, and two-seeded, white berries. One species, *C. alba*, has been used in Brazil and to some extent in Europe as a remedy for dropsy, snake bite, and other afflictions.

CHIOGGIA, kyōd'jā, city and commune, northern Italy, in the Province of Venezia, 15 miles south of Venice, at the southern end of the Venetian lagoon. It is situated on an island cut by three parallel canals, and is connected with the mainland by an 800-foot stone bridge; the harbor, one of the great fishing ports of Italy, was improved in 1935. One fourth of the population lives on fishing. Truck farming has become important on nearby reclaimed areas. There are shipyards and manufactures of soap, cement, sails, and lace. The city's atmosphere, with the old houses built on the canals, is strongly reminiscent of Venice. The cathedral, rebuilt by Baldassare Longhena in 1633-1674, and other old churches, have paintings of the Venetian school. Chioggia's city plan is probably of Roman origin. In the 8th century the town came under Venice and shared its history for centuries. The last

phase of the wars between Genoa and Venice for supremacy in the Mediterranean is called the War of Chioggia (1378-1380), because the decisive episode of the surrender of the Genoese fleet took place in the lagoon around Chioggia. Pop. commune (1951) 49,238.

CHIOS, kī'ōs, or **KHIOS**, kē'ōs (Turk. SAKIS-ADASI), island in the Aegean Sea belonging to Greece, five miles off the west coast of Asia Minor, from which it is separated by a channel 5 to 15 miles wide. The island is about 30 miles long from north to south and from 8 to 15 miles wide; its area is 321 square miles. With two small nearby islands it forms a nome (administrative department) of the Aegean Islands division of Greece. The island is mountainous in the north, where Mount St. Elias rises to over 4,000 feet, and has a fertile plain in the southeast where wine, figs, olives and olive oil, silk cocoons, and citrus fruit are produced. The aromatic liqueur called mastic is a typical product of Chios. Sheep and goat raising, and tanning are also important. There are marble quarries, antimony mines, and sulphur springs. The climate is delightful and the island is noted for its scenic beauty. On the east coast Chios, the capital and chief town, has a busy harbor. In ancient times it was famous for its school of epic poets and for its sculptors. Few remains are left, but interesting ancient coins have been found. On the west coast is a rich monastery, Nea Moni, founded in the 11th century, with Byzantine mosaics of the same period.

Ancient Chios claimed the honor of being Homer's birthplace. It was colonized by the Ionians. In the 6th century B.C. the island submitted to the Persians under Cyrus and suffered severe reprisals after the failure of the Ionian revolt in 494 B.C. against Persian rule. In 478 B.C. Chios joined the Delian League and regained its independence; it remained an ally of Athens even after the end of the Peloponnesian Wars. Chios prospered under the Romans and Byzantines, especially in its wine trade. Later it passed to the Seljuk Turks, Venetians, and Genoese; after 1346 A.D. it was actually in the hands of a Genoese trading company, but retained its right to self-government. In 1566 it was conquered by the Turks and remained a part of the Ottoman Empire until the Balkan Wars of 1912-1913, when it was awarded to Greece. In the anti-Turkish rebellion of 1822 a massacre of Christians took place here. During World War II, British and Greek troops landed on Chios in October 1944. Pop. (1940), island 72,777; city 26,617.

CHIPMAN, Nathaniel, American jurist: b. Salisbury, Conn., Nov. 15, 1752; d. Tinmouth, Vt., Feb. 15, 1843. For part of the Revolutionary War he was an officer in the American Army. Admitted to the bar in 1779, he was a member of the legislature in 1784 and in 1787 was elected assistant justice of the Supreme Court of Vermont; in 1789 chief justice and one of the commissioners to adjust the differences between New York and Vermont. In 1791 he was a member of the convention called to decide whether Vermont should join the Union, and became a joint commissioner with Lewis R. Morris to attend Congress and negotiate for the admission of Vermont into the Union. In 1793 he published *Sketches of the Principles of Government and Reports and Dissertations*. Elected chief justice again in 1796, he was the principal reviser of the code of

statute laws for Vermont. From 1798 to 1804 he was a United States senator. Another term as chief justice followed in 1813, and in 1816 he became professor of law in Middlebury College. His brother, Daniel Chipman, wrote his biography, *Life of the Hon. Nathaniel Chipman* (1846).

CHIPMAN, Ward, Canadian jurist: b. St. John, New Brunswick, July 10, 1787; d. there, Nov. 26, 1851. He was the son of Ward Chipman (1754–1824), a Massachusetts Loyalist who went to New Brunswick after the American Revolution. In 1805 he graduated from Harvard and pursued a legal career. In 1820 he was elected to the House of Assembly and became speaker in 1823. He acted as crown agent (1824–1829) in determining the boundaries of Maine and Nova Scotia, became puisne judge of the supreme court and chief justice of New Brunswick in 1834. He sat in the Legislative Council (1824–1842), where he became president.

CHIPMUNK, chip'mŭnk, any of a number of small ground squirrels of the genera *Tamias* and *Eutamias*, with a slender furred tail nearly as long as the body, and a coat of reddish brown fur, striped with white on the back. Some 17 species are known, ranging across Eurasia from northeastern European Russia to the Pacific and across the entire North American continent in wooded regions. All but two species occur in western North America, the genus *Eutamias* being particularly well represented in California. The ground color and the pattern of stripes are extremely variable, according to species and habitat. They are often seen running from stone to stone or along the ground, stopping now and then to sit erect, darting sharp glances at moving objects. The home is a tunnellike burrow, sometimes 20 feet long and always deep enough to reach below the frost line. It is enlarged into chambers at intervals, one of which, supplied with dried leaves and grass, is the sleeping apartment, the others, storehouses. In them the chipmunk stores his winter supplies of acorns and other small nuts, which he carries home, often several at a time, in his distensible cheek pouches. Buds, insects, and other plant and animal food are also eaten.

The breeding season is in the spring and the young are usually from four to six in number. The chief enemies of chipmunks are snakes, hawks, cats, foxes, and weasels. Most of these are dangerous only in the open, as they are too large to disturb a chipmunk at home. A weasel, however, can attack him in his burrow and to avoid him the chipmunk makes an opening for possible escape at the far end of the burrow.

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KARL KOOPMAN.

CHIPPAWA, chip'ă-wă, village, Province of Ontario, Canada, in Welland County, situated on the Niagara River at the junction of Welland River (formerly Chippawa Creek) about 2½ miles above Niagara Falls. The name is a popular adaptation of "Ojibway," a numerous and widely distributed tribe of Algonquian Indians (see

CHIPPEWA). The first settler in the vicinity was Thomas Cummings in 1783; the village was founded by United Empire Loyalists a year later. Chippawa is known to history from the battle in the vicinity between American and British forces during the War of 1812, described in the following article. Originally the upper landing place of the portage around the great cataract, the village now marks the intake for the large Queenston power plant of the Hydroelectric Power Commission of Ontario, six miles below the falls. A large manufactory of artificial abrasives is the only important local industry. Pop. (1951) 1,762.

CHIPPAWA, Battle of. An action of the War of 1812 between American and British forces which took place on July 5, 1814, resulting in a decisive American victory. The campaign of which it was an early incident, and which aimed at the recovery of the Niagara frontier and the occupation of the peninsula, was the most bitterly fought of the northern war on land. Under orders from Secretary of War John Armstrong, Maj. Gen. Jacob Jennings Brown, a resourceful and intrepid commander who had succeeded the vacillating James Wilkinson, had crossed the Niagara from Buffalo on July 3 and in a few hours had reduced Fort Erie stockade, taking prisoner its garrison of 170 regulars. Thence, with Winfield Scott, Eleazar Wheelock Ripley, and Peter Buell Porter as brigade commanders, and with a total force of 3,500, he advanced 14 miles down the river to Street's Creek (now Usher's Creek), a shallow stream 20 feet wide, behind which he halted for reconnaissance. Meanwhile Maj. Gen. Phineas Riall, the British commander at Fort George at the mouth of the Niagara, had hastened upriver to Chippawa where he collected a force of about 1,500 regulars belonging to the Royal Scots, Kings, the Hundredth, and the Hundred-and-Third regiments, with artillery and a few dragoons, and 600 militia and Indians. These he posted unassailably behind the Chippawa River, here crossed by a bridge into the village. On the open plain two miles long between Street's Creek and the Chippawa, with the Niagara on the east and wooded terrain on the west, the battle was fought.

It was opened by Brown sending Porter's militia detachment to protect a bridge under construction further up the Chippawa intended for an attack on Riall's flank. Porter, however, was in turn outflanked and driven back in confusion by Riall who, abandoning his position behind the Chippawa, now rashly seized the moment for an advance in order of battle upon the main American force. Inexperience in actual war and an underestimate of the quality of the superior American Army (which had been drilled to a new mobility and efficiency by Brown) must account for Riall's movement. No less impetuously Scott, under artillery fire, threw his brigade across the creek to meet it, deploying into line as he advanced, with Ripley in support, and extending to prevent an enfilade. The two lines met in a withering fire of musketry and artillery under which the British broke and fled over the Chippawa, leaving a third of their effectives in killed and wounded (511) on the field, the American losses (almost entirely in Scott's and Porter's brigades) being somewhat less than half. Two days later Riall retreated to Fort George. Brown following as far as Queenston but eventually falling back to Niagara Falls where the still bloodier Battle of Lund-

Lane (q.v.) was fought on July 25. Later Fort Erie was abandoned and blown up. The Chippawa victory remains primarily a tribute to improved American generalship and morale over the earlier phases of the land war. "Small as the affair was," says Henry Adams, "and unimportant in military results, it gave the United States Army a character and pride it had never before possessed."

CHIPPENDALE, chip'en-däl, Thomas, English cabinetmaker: b. Otley, Yorkshire, England, 1718?; d. London, November 1779 (buried November 13). The most famous of English makers of furniture, his name is still used to denote a style. For many years little was known about this master other than his book, *The Gentleman and Cabinet-Maker's Director*, published in London on March 23, 1754. A second edition appeared in 1759 and a third in 1762, and the number of full-page plates was increased from 161 to 200. Additional documented facts are now known about his life.

He was a Yorkshire man, baptized at Otley on June 5, 1718. His father, John Chippendale, was a maker of joined furniture. About 1727 father and son migrated to London, where the elder worked as a journeyman and the son served his apprenticeship. In 1748, Thomas Chippendale married Catherine Redshaw and the following year opened his own cabinetmaking shop in Conduit Lane, Long Acre, at that time the center of furniture making in London. He remained at that address until 1753, when he moved to 60 St. Martin's Lane. His establishment there was presumably more of a display place than a workshop; it was a meeting place where London fashionables exchanged the gossip of the day and incidentally saw some of the new pieces of furniture designed by Chippendale and executed by his journeymen. Josiah Wedgwood and his London partner, Thomas Bentley, for a time displayed their china there and several artists had studios in the building.

About the year the *Director* was published, James Rannie became Chippendale's partner. Despite a fire in the workshop in 1755, the firm's business and prestige continued to grow. In 1760, on the nomination of Sir Thomas Robinson, an amateur architect of importance and former governor of Barbados, Chippendale was elected to the Society of Arts. Its membership at that time included many men famous in art or science—Robert Adam, the architect; John Julius Angerstein, whose paintings were the nucleus of the National Gallery; David Garrick, Oliver Goldsmith, Edward Gibbon, William Hogarth, Dr. Samuel Johnson, James Boswell, and Benjamin Franklin—besides a number of peers including the dukes of Devonshire, Portland, Richmond, the earl of Sandwich, and the earl of Chesterfield.

Chippendale made furniture for a number of the leading country mansions. Among them were Nostell Priory in Yorkshire, where several pieces and the bills for them are still preserved; Stourhead House in Wiltshire, and Rowton Castle in Shropshire. From 1765 to 1771 he designed and made a considerable amount of furniture for Harewood House, seat of the earl of Harewood near Leeds in Yorkshire. Dating about this time also is a bookcase made for the earl of Chesterfield. This sold for 1,800 guineas when the contents of Holm Lacy were dispersed in 1937.

In 1766 Rannie died and from March 2d to

24th there was a liquidation sale of the cabinet lumber on hand. For four years Chippendale conducted his business alone, then took Thomas Haig into partnership; the firm's name became Chippendale, Haig & Company and continued until 1822, when Chippendale's son, Thomas II, retired from business. Catherine Chippendale died in 1772 and was buried at St. Martin-in-the-Fields. Four years later he married Elizabeth Davis. He apparently prospered, for in 1778 he was assessed £66 on the parish rating books, a tidy amount for that period. He died in November 1779 and was buried in a vault in St. Martin-in-the-Fields. His age was recorded as 62. Of the eleven children who survived, Thomas II carried on his father's business in partnership with Haig. He was more of an artist than a cabinetmaker; several of his paintings were shown in the Royal Academy exhibitions of 1792 and 1798. See also CHIPPENDALE FURNITURE; FURNITURE.—English (Chippendale Period); FURNITURE, AMERICAN.

CHIPPENDALE FURNITURE. The period from about 1750 to 1775 is generally conceded to represent the golden age of English furniture design and craftsmanship. It bears the name of Thomas Chippendale (q.v.), most famous of all English cabinetmakers. He dominated the design and manufacture of fine furniture in London, and influenced the craftsmen of Dublin and the American colonies to such an extent that examples of their production are now known as Irish Chippendale and American Chippendale.

Chief characteristics of the Chippendale school of furniture are structural soundness and solidity, made graceful by use of flowing lines and well-executed carved details. In scale the pieces are ample enough for comfort and, structurally, they are well adapted to the purposes for which they were made. Details include bold cabriole legs terminating in claw-and-ball feet, straight molded legs, plain, fluted, or reeded on the outer sides, sometimes ending in the square Marlborough foot; pierced and carved back splats for chairs; serpentine or bowed fronts for chests of drawers and other case pieces; and broken pediment tops surmounting such tall pieces as secretaries and, in America, highboys and chests-on-chests. Carved ornamentation is done in such motifs as shell, scroll, foliage, and gadroon or Chinese frets. Mahogany was used almost to the exclusion of other woods, save in the American colonies, where some pieces were made of walnut by Philadelphia craftsmen, and of cherry by those of New England. In general line and proportion the Chippendale style was developed from the Early Georgian which, in turn, was derived from the furniture of the Low Countries with its inherent stiff heaviness. This was replaced by more graceful curves and flowing lines in the early Chippendale. As this style developed, almost simultaneously its breadth and scope were enhanced by elaborate adaptations from furniture of the Louis XV period, known as French manner Chippendale; the Chinese Chippendale in which details were adapted from ornamentation and architecture of the Celestial Empire, and the Gothic Chippendale wherein lines and details reflected Gothic architecture.

Furniture of the Chippendale period, as made in his own shop and by his London contemporaries, has been studied by antiquarians and students of design for more than half a century. Great interest attaches to Chippendale's *The Gentleman and Cabinet-Maker's Director*, first published in

London in 1754. The copperplate engraved illustrations in the *Director* were all in the nature of fashion plates and were not intended to be actual working drawings. With most of the pieces depicted, at least two different decorative treatments are shown, such as a side chair with one front leg cabriole shaped and carved, the other square and fretted, and the seat rail half plain and half fretted. Many of the chairs are shown with an arm at the right and none at the left, thus serving to depict it as either an armchair or a side chair. Some of the French commode tables show two variations for the same piece, one with full-width drawers and the other with a pair of hinged doors concealing the drawers contained within. With one of the designs for a chest-on-chest, four decorative treatments are shown and most of the plates for pedestal desks show at least two. The three editions of the *Director* present designs for 162 pieces of furniture; 41 for decorative accessories, such as girandoles, hanging shelves, and brackets, and 42 for details, such as cornices, fretwork, and shields for pediments. To one piece, a breakfast table with narrow drop leaves which Chippendale made for the earl of Pembroke, he gave the name of his client. As a result "Pembroke" became the standard designation for this type of table during the furniture periods that followed, and still continues to be used.

In the *Director*, Chippendale presented ideas for furniture design that had not previously reached beyond fashionable London. A considerable number of provincial cabinetmakers subscribed to the book, and thus his genius as a designer was followed by many working outside the London area. His followers and imitators were numerous in England, Ireland, and the American colonies. There, especially with the cabinetmakers of Philadelphia and some of the master craftsmen of New England, Chippendale designs were skillfully adapted to local tastes, and some of the finest American furniture resulted. A high point with these were distinctive highboys and lowboys and cabriole-leg chairs with pierced back splats that came from shops of such Philadelphia craftsmen as William Savery and Benjamin Randolph. Among the four styles of Chippendale furniture, outstanding designs are those typified by French commode tables, china cabinets, and elaborate canopy beds in the Chinese manner, and the Gothic breakfront bookcases and sideboard tables. See also FURNITURE—English; FURNITURE, AMERICAN.

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THOMAS H. ORMSBEE.

CHIPPENHAM, chip'en-ām, municipal borough, England, in Wiltshire, on the left bank of the Avon River, 12 miles east-northeast of Bath on the Great Western Railroad. Its name, derived from the Saxon *cyppan*, to buy, indicates its early existence as a market town. Listed in Domesday Book (1085) as a crown manor, its records go still further back to the 9th century and the Danish invasion. An ancient stone bridge of 22 arches, a 15th century parish church, and an old town hall are among its surviving points of interest. It is in a dairying region, manufactures

agricultural machinery, processes cheese, and cures bacon. Incorporated in 1553. Pop. (1951) 11,850.

CHIPPEWA, chip'ë-wā (a popular adaptation of the word "Ojibwa," meaning "gathering," referring to a style of moccasin which was gathered over the toe area), the largest Algonquian-speaking division, and one of the largest tribes of North American Indians. Their territory, at its largest extent, included much of the region from the Niagara River westward to Turtle Mountains, N. Dak., and from Wisconsin and Michigan northward about halfway to Hudson Bay. When first met by French traders and missionaries in the mid-17th century, they lived in the vicinity of Lakes Huron and Superior, their largest number residing near Sault Ste. Marie. Their population at that time has been estimated at 35,000.

The Chippewa were traditionally a woodland people who lived in scattered, loosely knit bands or villages in the forests bordering lakes and streams. Although they raised small gardens of corn, beans, squash, and pumpkins, they depended primarily upon hunting, fishing, and collecting of wild plant foods for subsistence. In the fall they gathered quantities of wild rice growing in the still waters of lakes and ponds. In early spring they made maple sugar. Their homes were built of pole foundations covered with birch-bark or rush matting. Their clothing of buckskin was decorated with porcupine quillwork. (In more recent times Chippewa craftsmen have employed elaborate floral designs in beadwork.) They constructed light birch-bark canoes and performed much of their travel by water routes connected by portages. In their religious ceremony of the mide'wiwin, observed each spring and fall, the sacred songs were recorded in the form of pictures incised upon birch-bark scrolls. They were effective orators and able storytellers. Chippewa stories provided much of the background for Henry Wadsworth Longfellow's well-known poem, *Hiawatha*.

About 1670 the Chippewa obtained firearms from white traders. In the next century they pushed westward, driving the Fox Indians from northern Wisconsin and forcing the Sioux south of the Minnesota River and across the Mississippi. After the Sioux obtained both firearms and horses, they were able to counter the aggressive thrusts of the pedestrian Chippewa with greater success. A group of the Chippewa moved out of the forests onto the grasslands west of the Red River of the North about 1800. They adopted many traits of Plains Indian culture and became known as the Plains Ojibwa.

The Chippewa ceded much of their land in the United States in a series of treaties and agreements, beginning as early as 1785. They now live on reservations within their former territory in Minnesota, Michigan, Wisconsin, and North Dakota, and in Ontario, Manitoba, and the Northwest Territories of Canada. Since the early days of French settlement the Chippewa have had a large admixture of white blood. Of a total Chippewa population in excess of 50,000 in 1950, probably fewer than 20 per cent were full-bloods.

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JOHN C. EWERS,
United States National Museum.

CHIPPEWA FALLS, city, Wisconsin, lake resort, and Chippewa County seat; altitude 859 feet; on the Chippewa River near Lake Wissota; 10 miles northeast of Eau Claire; on the Chicago, Milwaukee, St. Paul and Pacific; Minneapolis, St. Paul & Sault Ste. Marie; and Chicago and North Western railroads. It is in an agricultural and dairying region, has creameries, canneries, and breweries. Other factory products are plastics, fishing lures, hydraulic pumps, shoes, woollens, corded yard, packed meats, mattresses, gloves, silos, doors and sashes, and other woodworking. The great hydroelectric plant of the Northern States Power Company is here; and the state headquarters of the Farmers Union; the state home for the feeble-minded; and a fine county courthouse. Tone Rock battlefield near the city was the scene of a Sioux-Ojibway conflict. Jonathan Carver, English explorer, visited the Indian village in 1766. A sawmill and dam were built here in 1836 by French-Canadians. The beautiful natural Irvine Park is located nearby. The Indians gave up their right to the Chippewa Valley in 1837 and Chippewa Falls soon became a lively lumber town. Pop. (1950) 11,088.

CHIPPING SPARROW, one of the most widely spread and familiar of North American sparrows (*Spizella passerina passerina*) of the linc family (Fringillidae), seen in summer by every roadside and in every garden of the United States east of the high plains and northward to Labrador and Great Slave Lake in the Northwest Territories of Canada. The "chippy" is of small size, has the streaked gray plumage of the sparrow, and is to be distinguished at a glance by its chestnut cap and plain white breast. It comes from the south in early spring and makes its home fearlessly near the house, forming a neat nest in some bush or vine, where its high-pitched trill—a monotonous *chippy, chippy, chippy*—is heard until late summer. The nest, made of grasses and fine twigs, is sometimes lined with horsehair; and this sparrow is often called hairbird. The five eggs are greenish blue, sparsely speckled with brown. It feeds its young, of which two broods are frequently raised, on aphids, small caterpillars, and other (usually injurious) insects; and at other times is a diligent eater of weed seeds. Both these services contribute to the beneficial effects of the chipping sparrow, and its home should not be harmed.

CHIPS FROM A GERMAN WORKSHOP, by (Friedrich) Max Müller (q.v.). This collection of special studies, incidental to the author's editing of a library of the *Sacred Books of the East*, appeared in four volumes (1867-1875).

CHIQUICHQUI PALM, *chē'kē-chē'kē*, either of two South American palms, the *Leopoldinia piassaba* or the *Attalea funifera*, yielding piassava fiber which is used in making ropes, mats, and brushes. It grows in swamps and along river banks. The coquilla nut is the fruit or nut of *Attalea funifera*. See also *ATTALEA*.

CHIQUIMULA, *chē-kē-mōō'lā*, city, Guate-

mala, Central America, capital of the department of the same name in the southeast of Guatemala, at an altitude of 1,378 feet, on the railroad to San Salvador. Chiquimula has valuable mineral deposits, raises cattle, and grows fruit, tobacco, sugarcane, wheat, and corn. Earthquakes greatly damaged the town in 1765 and 1773. The volcanoes Ipala and Quezaltepeque are nearby. Pop. (1950) city 8,848; department 112,275.

CHIQUINQUIRA, *chē-kēng-kē-rā'*, town, central Colombia, South America, in the Department of Boyacá, 75 miles north-northeast of Bogotá, Colombia's capital. At an altitude of 8,432 feet, it is on the Bogotá-Barbosa Railroad and is a market for sugarcane, coffee, corn, wheat, and potatoes, besides stock, cotton, and silk. Founded in 1586, the town each year attracts about 60,000 visitors to the shrine of Our Lady of Chiquinquirá in the lovely church built of local marble. Nearby are emerald mines. Its educational facilities include a state college, a private college of philosophy and letters, three colleges for women, and one higher school for men. Pop. (1938) 6,998.

CHIKITOS, *chē-kē'tōs*, a group of Indian tribes occupying the plains of the same name in eastern Bolivia. These Indians were agriculturalists and lived in fortified villages, which were politically autonomous. An undetermined number of them spoke languages of the Chiquitano stock. They were discovered in 1543 by the Alvar Núñez Cabeza de Vaca expedition which ascended the Paraguay River in search of the mythical El Dorado, and were conquered by another such expedition in 1557-1560. Released from Spanish rule when the city of Santa Cruz was moved westward in 1595, they reverted to their aboriginal mode of life. They suffered heavily from slave raids until the coming of Jesuit missionaries in 1691. The Jesuits grouped the Chiquitos into eight large and prosperous missions, but these were abandoned when the Jesuits were expelled in 1767, and the Indians slipped back into a half barbarous condition, in which they have remained. They have adopted many modern customs and were good agriculturalists and expert basket makers when studied in 1908. They still played the native rubber ball game and, during Christian feasts, danced with their faces hidden by cloth masks and their bodies covered with ostrich feathers. In 1766 the Jesuits calculated the population of Chiquitos at about 23,788; in 1831 it was 14,925. The present number of Chiquitos is not known.

IRVING ROUSE,
Professor of Anthropology, Yale University.

CHIRICO, *kē'rē-kō*, Georgio di, Italian painter: b. Volo (now Volos), Greece, July 10, 1888. Moving with his family to Athens, Chirico accomplished little at an art academy but preferred to roam about the classic ruins of the ancient city, forming his own ideas of art. After his father's death (1905), he went to Munich. There he was influenced by Friedrich Wilhelm Nietzsche to paint his dreams, and from 1908 his works were enigmatic. From 1908 to 1911 he lived in Italy, chiefly in Florence. He began working in Paris in 1911 and was one of the first surrealists. Two paintings on triangular canvases are examples of his originality: *The Serenity of the Scholar* and *The Enigma of Fatality* (both

1914). James Thrall Soby, author of *The Early Chirico* (1941), said, "His painting is hard to classify, since it is Italian but not Futuristic, Parisian but not Expressionist or Cubist, European but not traditional."

Chirico was also a stage designer and the author of *Hebdomeros* (1929). His paintings are to be seen in galleries in Rome, Moscow, Chicago, Buffalo, and New York.

CHIRIQUEI, chē-rê-kē', province, western Panama, on Pacific slope, adjoining Costa Rica. With an area of 3,693 square miles, it is served by railroads, motor launch, and highways, including the Inter-American Highway. It produces bananas, coffee, rice, corn, and sugarcane, much of which it exports to the United States, and is a center for lumbering and cattle raising. There is also manufacturing of shoes, soap, clothing, furniture, and other products, chiefly at David, the provincial capital. The Chiriquí volcano is within the province, through which flow the David, Chiriquí, and Chiriquí Viejo rivers. It was organized in 1850. Pop. (1950) 137,422.

CHIRIQUEI, village, Chiriquí Province, western Panama. On the Inter-American Highway, it is 7 miles east-southeast of David, capital of the province. It raises livestock and grows bananas, coffee, and cacao. Pop. (1940) 922.

CHIRIQUEI, isthmus, in the westernmost part of Panama, extending about 45 miles from the Pacific on the south, at Chiriquí Gulf, to the Caribbean on the north, at Chiriquí Lagoon. Bananas, coffee, rice, yucca, corn, and sugarcane are grown in this area.

CHIRIQUEI, river, western Panama, a non-navigable stream flowing southward for 45 miles from Cerro Horqueta, a peak of the Continental Divide, to the Pacific. It is joined by the Caldera River and empties into the same delta as the David River.

CHIRIQUEI, volcanic peak, long inactive, at the highest point of the Cordilleras in Panama, at an altitude of 11,067 feet. The range is sometimes known as the Sierra de Chiriquí, and the volcano as Barú. It is close to the Costa Rica border, just south of the Continental Divide, 28 miles from the manufacturing city of David.

CHIRIQUEI, Gulf of, an inlet of the Pacific Ocean at the extreme southwest part of Panama. Much of the commerce of David, major agricultural center in this section of the country, passes through Pedregal, its port on the gulf. Puerto Armuelles and Burica Peninsula form the western side of the gulf, which is 80 miles wide and 15 miles long. There are several islands in the bay, including Coiba, a penal colony.

CHIRIQUEI GRANDE, grăn'dà, village, Bocas del Toro Province, western Panama. This tiny port on the Caribbean Sea is situated about midway along the southern shore of Chiriquí Lagoon, 26 miles south-southeast of Bocas del Toro, capital of the province. Stock raising and lumbering are carried on near the village, and the port ships bananas, tobacco, rubber, coconuts, cacao, and abacá, the fiber for making Manila hemp. Pop. (1940) 64.

CHIRIQUEI LAGOON, an inlet of the Caribbean Sea in northwestern Panama, west of Mosquito Gulf. It lies between Valiente Peninsula on the east and Bocas del Toro Archipelago on the west. The lagoon provides a fine natural harbor for the movement of agricultural products out of the port of Chiriquí Grande.

CHIRIQUEI VIEJO RIVER, vyé'hô (Span. *viejo*, old), western Panama. Rising in the mountain range near Chiriquí volcano, it flows south for about 50 miles to the Pacific at Charco Azul Bay. In its lower reaches it is navigable to small vessels for about 6 miles.

CHIROGALE, kí'rô-gāl, or **MOUSE LEMUR**, any of three species of small lemurs of the genus *Cheirogaleus*, native exclusively to Madagascar. They live in trees and at the approach of the dry season curl up in a hollow place in a tree and sleep until the rainless time is over. Like hibernating animals of cold regions, they accumulate a large deposit of fat before becoming torpid, and when they awake have regained their normal condition. They feed chiefly on fruits and insects and build nests somewhat like a bird's. The dwarf lemur *Microcebus*, and the fork-marked lemur *Phaner*, also of Madagascar, are closely related and similar in most respects. See also **LEMURS**.

CHIROMANCY, kí'rô-măn-sî, the practice of attempting to foretell the future of a person by inspecting the lines of his hand, in the markings of which chiromancy professes to see a line of life and a line of fortune. In the general acceptance of the term, chiromancy, among students of the so-called art of palmistry, is restricted to the sense of foretelling the future by means of an examination of the palm of the hand, while chirosophy is applied to the interpretive science of the hand. It will be thus readily seen that the two terms have a tendency toward overlapping. As a science chiromancy or palmistry deals with the "seven mounts" of the hand, their lines and the interlacings of the latter. The names given to these mounts, Jupiter, Saturn, Apollo, Mercury, Venus, Mars, and the Moon at once connect the practice of chiromancy with the art of divination as carried on by means of a study of the stars. The mount of Jupiter is situated at the base of the first finger; that of Saturn, the middle finger; that of Apollo, the ring finger; that of Mercury, the little finger; that of the Moon, the wrist; that of Venus, the thumb; while that of Mars is beneath that of Mercury.

Chiromancy is a very ancient practice and seems to have been at one time in pretty general use among most of the peoples of Europe, of India, and of Egypt. It very probably had its origin in the ceremonies by the medicine men, diviners, and priests of very primitive times, to determine good and bad omens. The Assyrians, Hebrews, Chaldeans, Greeks, and Romans paid particular attention to the study of chiromancy. From a purely priestly institution it was degraded until it became a tool in the hands of unscrupulous fortunetellers who were often as ignorant and credulous as their dupes. But before it arrived at this latter stage, it had reached a position where it was looked upon as being as exact a science and as worthy of careful study as any of the sciences of the age. Men of the highest rank, position, intelligence and educa-

tion gave their time to its study. Already, in the early Middle Ages, it had begun to claim the attention of the studious and, a little later, the art was being practiced by a professional class, who took the place of the ejected pagan priests, and exploited the rich and poor alike. But all who practiced palmistry were not of this class; for there were many who undoubtedly believed in the art, which was taught in schools and colleges. However, in an age of extreme ignorance, the temptation to exploit a willing public became gradually greater; and chiromancy degenerated into palmistry and the latter into "fortune telling."

CHIRON, kī'rōn, in Greek mythology, the son of Kronos (Saturn) and Philyra. Kronos assumed the shape of a horse, in this amour, to deceive his wife Rhea.

The shape of Chiron, therefore, was half that of a man, half that of a horse. In point of fact, Chiron was one of the Centaurs. He was celebrated through all Greece for his wisdom and acquirements; and the great princes and heroes of the time were represented as his pupils. He was particularly skilled in surgery. When Hercules drove the Centaurs from Mount Pelion, they took refuge with Chiron in Malea; but their enemy pursued them even into this retreat and unfortunately the old teacher was wounded with a misdirected arrow. The speedy operation of the poison in which the arrow had been dipped rendered remedies useless; and Chiron suffered the severest torments. The gods, at his prayer, put an end to his life, though his nature was immortal by reason of his descent from Kronos. After his death he was placed among the stars and became the constellation Sagittarius.

CHIROPODY (PODIATRY), kī-rōp'ō-dī, (Gr. *cheir*, hand; and *pod*, foot). Defined as that specialty of the healing arts which is concerned with the care of the human foot in health and in disease. It consists of the prevention, diagnosis, and treatment of foot disorders by surgical, medical, electrical, and mechanical means, except the amputation of the toes or foot. Chiropody is a comparatively new medical specialty profession and until recent years was not well known by the general public. However, due to work performed by chiropodists in hospitals, government and state institutions, and the establishment of more private practices throughout the country, the profession has gained more prominence. That the services of chiropodists are appreciated by the medical profession is evidenced in the statement of the Judicial Council of the American Medical Association, "Chiropody is a practice ancillary—a hand maiden—to medical practice in a limited field. General opinion seems to be that chiropody fairly well satisfies a gap that the medical profession has failed to fill." Also, Elliott P. Joslin, M.D., of Harvard University has stated, "I think the work done by chiropodists, particularly for diabetic patients in hospitals, is invaluable—I heartily favor the association of chiropodists with doctors and surgeons in the hospitals of the country."

History.—Although chiropody was practiced in the sense of "giving the human foot special care" in the era of 372 B.C., it first came into recognition as a healing art when the guilds of barber-surgeons were popular in northern Europe during the 14th century. The term chiropody was first used to designate the science of foot care in 1785 when a practicing foot specialist in England published a treatise called *Chiropodologia* which dealt with the cause of painful and offensive cutaneous excrescences of the foot. In 1840 the first permanent chiropody office was es-

tablished in Boston, Mass., by Dr. Nehemiah Kenison.

Organization.—The National Association of Chiropodists was founded in 1895 and has affiliated state societies in every state in the United States. Its official publication is the *Journal of the National Association of Chiropodists*—founded in 1907. There are six specialty affiliated organizations—The American College of Chiropodists, The Fellows Podic Research Society, The American College of Foot Surgeons, The Fellows of the American Academy of Chiropodists, The American Society of Chiropodical Roentgenologists and The Military Association of Chiropodists.

Education.—In the United States there are six colleges of chiropody which have been approved by the Council on Education of the National Association of Chiropodists and are located in California, Ohio, Illinois, Pennsylvania, and New York. Entrance requirements and other data may be obtained from the executive secretary, National Association of Chiropodists, Washington, D.C.

Military.—Although chiropody received recognition from the armed forces during World War I, it was recognized as a qualified specialty organization in World War II. Eighty chiropodists served as commissioned naval officers. There were 2,900 chiropodists who served in various noncommissioned (navy and army) officer grades. A course in military chiropody was established at Temple University School of Chiropody (Philadelphia) in 1940. In 1944 chiropodists were admitted to membership in the Association of Military Surgeons of the United States. Former Surgeon General of the Navy, Ross T. McIntire, said "there is a place for these scientists in any health organization and these officers performed a commendable service which is essential to the health of personnel." Provision is being made for the commissioning of chiropodists in regular government health services including the Veterans Administration.

CLARENCE A. HIGGINS,
Member, Board of Directors, California Association of Chiropodists.

CHIROPRACTIC, kī-rō-prāk'tic (Greek *cheir*, hand; and *praktikos*, efficient). "A system of therapeutics based upon the theory that disease is caused by interference with nerve function. It is based upon the premise that all systems and physiologic processes of the human body are co-ordinated by the nerve system; that interference with the nerve control of these systems impairs their function and induces dysfunction or disease by rendering the body less resistant to infection or to other exciting causes. Its therapeutics is designed to restore normal function of the nerve system by scientific manipulation, specific adjustment, clinical nutrition and physiotherapeutic treatment of the structures of the human body, especially those of the spinal column."¹

Historical.—The principles upon which the science of chiropractic is based can be traced to the earliest physicians of antiquity. They were known and practiced by Hippocrates, the Father of Healing (460-370 B.C.), by Galen (130-200 A.D.) and other noted physicians of ancient Greece and Rome. Descriptions of this method of treating bodily ills are also to be found in the ancient manuscripts of the Egyptians, Hindus and Chinese.

Lost for centuries, the principles of this system of practice were rediscovered by Dr. Daniel David Palmer and the first chiropractic adjustment of a vertebral articulation was given by him on Sept. 18, 1895.

The founder of this system of healing, in his comprehensive text and reference work, *The Science, Art and Philosophy of Chiropractic*, published in 1910, declared that chiropractic was "the science of adjusting by hand any and all luxations of the articular joints of the human body; more especially the articulations of the spinal column,

¹ Definition officially adopted by the National Chiropractic Association in Los Angeles, July 1953.

for the purpose of freeing any and all impinged nerves which cause deranged functions." His concept included the theory that most dysfunction or disease results from a lack of tone in the tissues. The remarkable effectiveness of this method of treating disease has won for chiropractic a permanent place as one of the major professions in the family of health sciences.

Premise.—The science of chiropractic is based on the premise that disease results from a lack of normal nerve function. The efforts of the chiropractic physician are directed toward the restoration of the normal function of the nerve system, which controls all other systems and all physiological functions of the human body. The doctor of chiropractic treats, by scientific manipulation and specific adjustment, the structures of the body, especially the spinal column, to restore normal nerve function which enables the body's protective and restorative powers to function normally.

Chiropractic physicians are thoroughly trained in all methods of diagnosis and understand the significance of structural maladjustments which are always present in disease. They contend that the first requisite of health procedure is the maintenance of the mechanical integrity of the body—free from spinal defects and postural distortions. The practice of chiropractic is as broad as the nervous system, which controls the function of all organs, glands and tissues. Therefore, chiropractic is applicable to a wide variety of diseases which affect the human body and mind.

Chiropractors recognize the importance of spinal hygiene and sanitation, as well as the factors of infection, fatigue, trauma, and occupational hazards. Physiotherapeutic measures, such as light, cold, heat, air, water, diet, massage, electricity, and exercise, are used as indicated.

Educational.—To obtain recognition from the dominant organization of his profession, a doctor of chiropractic (D.C.) must have been graduated by one of the numerous approved chiropractic colleges. These schools, whose courses compare favorably with those of other scientific institutions, are located throughout the nation. The National Council on Education has established a rigorous standard for colleges seeking its endorsement. The standard approved minimum course of resident study comprises four academic years of not less than 4,000 class hours in a nonprofit educational institution having well-qualified professors and instructors and adequate library, laboratory, and housing facilities. As of 1953, eleven chiropractic colleges had received accredited ratings.

A list of chiropractic colleges meeting these requirements may be obtained by writing to Dr. L. M. Rogers, executive secretary, national chiropractic association, Webster City, Iowa. It is estimated that 2,500 new students enroll annually in chiropractic colleges. Numerous fraternities and sororities have been formed in the various colleges. The national association provides postgraduate training for doctors of chiropractic by conducting extensive research continuously and through clinical demonstrations and condensed courses given at its annual conventions, which are attended by 2,000 to 2,500 members of the profession.

Other chiropractic bodies which provide various forms of postgraduate work and are affiliated with the national organization are: The National Council of Hospitals and Sanitaria, National Council of Physiotherapy, National Council of Roentgenologists, National Council on Public Health, National Council on Research, and National Council on

Psychotherapy. The profession's outstanding periodical is the *Journal of the National Chiropractic Association*, official publication of the national association. This is supplemented by the *National News*, which is mailed to all members of the chiropractic profession. Every state has its own state association and the majority of these are affiliated with the national association. Most state societies publish their own monthly periodicals. Hospitals, sanatoriums, and clinics have been established in every state. To inform the public on chiropractic, *Healthways* magazine, a digest publication with a circulation of 110,000 copies monthly, and numerous brochures and booklets are published by the National Chiropractic Association.

In recent years chiropractic educators have made some very definite contributions to general human welfare through their studies on postural defects, sleeping habits, spinal hygiene, and correction and care of sacroiliac displacements and weaknesses. The Railroad Retirement Board, the Civil Service Commission, Workmen's Compensation Commission, Western Union Telegraph Company, and some 500 insurance companies are granting increasing recognition to the chiropractic profession due to its efficient handling of difficult accident and disability cases. The public health division of the National Chiropractic Association is conducting continuous research on the principles underlying the science of chiropractic and makes its findings known to the profession through periodical reports. Encouraging reports have been received in cases of poliomyelitis, spastic paralysis, diabetes mellitus, amnesia, and multiple sclerosis under chiropractic care.

Statistics.—The National Chiropractic Association estimated in 1953 that approximately 23,500 chiropractors were practicing in the United States and Canada, and an undetermined number were scattered throughout every civilized country of the world. The association announced that a recent survey revealed that more than 32 million people in the United States have, at one time or another, availed themselves of chiropractic service. More than 2,000,000 new patients experience the health benefits of chiropractic each year.

In 1951, the Executive Office of the President of the United States, Bureau of the Budget, classified chiropractic as one of the four major professions in the United States (804-8041) in the major group 80, which includes physicians and surgeons, dentists, osteopaths, and chiropractors. During World War II and later the Korean conflict, Congress passed S.1, which included deferment of chiropractic students as being "essential to the national health, safety and interest." Included in the scope and administration of the National Chiropractic Association are the National Chiropractic Insurance Company, the National Printing Company, and the Chiropractic Research Foundation. Activities include sponsoring of National Correct Posture Week May 1 to 7 each year, producing *Healthways-on-the-Air* radio transcriptions, *Chiropractic—A Career* brochures, two sound color movies—*Infantile Paralysis Finds a Cure* and *They Walk Again*.

As of January 1953, 43 states have granted legislative regulation to chiropractic practitioners. They are: Alabama, Arizona, Arkansas, California, Colorado, Connecticut, Delaware, Florida, Georgia, Idaho, Illinois, Iowa, Kansas, Kentucky, Maine, Maryland, Michigan, Minnesota, Missouri, Montana, Nebraska, Nevada, New Hampshire, New Jersey, New Mexico, North Carolina, North Dakota, Ohio, Oklahoma, Oregon, Pennsylvania,

Rhode Island, South Carolina, South Dakota, Tennessee, Texas, Utah, Vermont, Virginia, Washington, West Virginia, Wisconsin and Wyoming. In addition, the practice is legally regulated in the District of Columbia, Alaska, Hawaii and Puerto Rico; British Columbia, Manitoba, Alberta, Saskatchewan, and Ontario in Canada, and several foreign countries.

Since there are no chiropractic schools or colleges except in the United States and Canada, it naturally follows that many foreign students enroll annually. In accordance with Sect. 4(c) of the Immigration Act of 1924, certain chiropractic schools and colleges have been approved by the secretary of labor to cover residence of such students.

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L. M. ROGERS,

Executive Secretary, National Chiropractic Association, Inc.

CHIROPTERA. See CHEIROPTERA.

CHIROSOPHY, the interpretive science of the hand. See CHIROMANCY.

CHIROTES, kī-rō'tēz, **EUCHIROTES**, or **BIPES**, a lizard belonging in the family Amphisbaenidae, a wormlike, burrowing and usually limbless family. The genus *Chirotes*, however, is unique in that it retains a pair of forelegs which are extremely short and thick, and bear five digits with claws. It is eight to ten inches long, of a dusky flesh color, completely subterranean, burrowing in soft earth, and eating small insects and worms. *Chirotes* inhabits the Mexican peninsula of Lower California. See also AMPHISBAENA.

CHIROTHERIUM. See LABYRINTHODONTA.

CHIRU, chē'rōō, a large antelope (*Pantholops hodgsoni*) native to the plateau of Tibet, found at elevations of from 13,000 to 18,000 feet. It is about 32 inches tall and pale in color, with a much swollen muzzle somewhat like a moose. The buck has a black face and long horns somewhat like those of a gazelle; the doe is hornless and lacks the black face. Preferring grassy meadows to cliffs, it is very wary. This fine antelope has a thick covering of woolly hair, fawn-gray in color, and is related to the saiga of Central Asia.

CHISEL, chiz'l, an edged tool for cutting wood, iron or stone, operated by striking its upper end with a hammer or mallet, or by pressure. The form of chisel used in carpentry is the most familiar; one used in turnery has the cutting edge in the middle of the thickness, one used in metalurgy has the upper part flat for receiving the blow of the hammer, and the lower part in the form of a wedge for penetrating iron plates or bars. Some of the "celts" found in Europe in prehistoric times are believed to have been used as chisels, and these tools were known also to the ancient Egyptians. In ancient times chisels were made of stone and later of various kinds of metals. The more civilized of the native tribes of America were acquainted with the chisel. The Aztecs, Zapotecs, Mixtecas and races of Yucatan, Guatemala and other parts of Mexico made chisels of copper and stone.

CHISELMOUTH. See CHUB.

CHISHOLM, chiz'um, **Hugh**, English editor: b. London, England, Feb. 22, 1866; d. there, Sept. 29, 1924. He was educated for the bar but left the law for journalism. In 1899 he became editor of *St. James's Gazette* and in 1900 joined the staff of the *London Times*. He was coeditor with Sir Donald Mackenzie Wallace and A. T. Hadley, then president of Yale, of the tenth edition of the *Encyclopaedia Britannica* and editor in chief of the eleventh edition published in 1910-1911. He returned to the *Times* but in 1920 he reassumed the editorship of the *Britannica* for the twelfth edition. He was a sound scholar with great vision and excellent literary judgment.

CHISHOLM, Jesse, pioneer, guide, scout, interpreter and trader: b. Tennessee about 1806; d. March 1868. His father was a Scotsman and his mother a Cherokee Indian. He migrated to the West while the Cherokees occupied lands in Arkansas, being mentioned as one of the members of the tribe which accompanied Captain Dutch on his punitive expedition against the Towakony Indians in Texas, about 1827. He was one of the interpreters in the council held with the Wichita, Kiowa and Comanche tribes in the Red River country by Col. Henry Dodge and Governor Montfort Stokes, in 1834, and was prominent as a mediator in most of the councils, negotiations and treaties made between the government and the wild tribes of the Southern Plains from that time on. He became a trader among the Comanche, Kiowa and other tribes of the plains, and during the course of his trading expeditions he rescued by ransom nine captive children and youths (mostly Mexican) all of whom were adopted and reared in the family with his own children. His home was at Camp Holmes, on the Canadian River. He also established and maintained trading posts near the present towns of Lexington and Oklahoma City.

At the outbreak of the Civil War he was for a time prevailed upon to aid the Confederate authorities in negotiating treaties of alliance with various tribes in the Indian Territory but, in the latter part of 1861, was found among the refugee Indians who followed Opothleyahola northward to an asylum in Kansas. Tiring of life in the refugee camps, he soon drifted westward to the mouth of the Little Arkansas, where the Wichita and affiliated tribes of Indians had settled temporarily and where he engaged in trade.

In the spring of 1865, he went south from the Arkansas to the valley of the upper Washita on a trading trip, the road over which he traveled being ever afterward known as the Chisholm Trail, destined to become famous during the days of the overland cattle traffic. In the autumn of that year he was active in persuading the hostile Comanche and Kiowa leaders to attend the peace council at the mouth of the Little Arkansas.

Consult Taylor, T. U., *Jesse Chisholm* (Bandera, Texas, 1939).

CHISHOLM, city, Minnesota, in St. Louis County, about 8 miles northeast of Hibbing. An important mining and ore-shipping center, it is served by the Great Northern and the Duluth, Mesabe, and Iron Range railroads, and by Wisconsin Central Airlines. Industries include dairy products and beverages. Settled in 1898, Chisholm was incorporated as a town in 1901, and as a city in 1934. Pop. (1950) 6,861.

CHISHOLM v. GEORGIA, in the United States Supreme Court, the case which led the several States to protect themselves from legal responsibility to individuals, while retaining legal powers of aggression. The Constitution provides (Article III, section 2): "The judicial power shall extend to all cases—between a State and citizens of another State." Under this provision Maryland was sued soon after the adoption of the Constitution, and acknowledged process by her attorney general; but the case was compromised, and the question of jurisdiction did not come up. On July 11, 1792, Alexander Chisholm of South Carolina, as legatee in an inheritance case, served a process on the governor and attorney general of Georgia to appear before the August term of the Supreme Court. Georgia instructed its attorney general not to appear, and its counsel to enter a denial that states could be sued by individuals, or that the Supreme Court had jurisdiction in such cases, but not to argue the case. Chief Justice Jay and all the court, except Iredell of North Carolina, found that the court had such jurisdiction; and a writ of inquiry was issued, but not served because Georgia passed an act making service of it a capital offense. Virginia was as angry as Georgia; and the 11th Amendment to the Constitution was introduced into Congress, passed by two thirds of both Houses March 5, 1794, ratified by the states and declared in force Jan. 8, 1798. It reads: "The judicial power of the United States shall not be construed to extend to any suit in law or equity, commenced or prosecuted against one of the United States by citizens of another State, or by citizens or subjects of any foreign state." Efforts were made to get around this federal law by having a citizen assign his claim to the state of his domicile and having the suit then brought in the name of this State. But it was held that this could not be done (*New York v. Louisiana*).

CHISLEHURST and **SIDCUP**, *chíz'l-húrst* and *sid'kúp*, an urban district in Kent, England, 11 miles southeast of London. It was long the residence of William Camden, the antiquary, and was the residence of Napoleon III from his dethronement until his death in 1873. His body and that of the prince imperial (killed in Zululand in 1879) reposed here until their removal to Farnborough in 1888. Pop. (1947 est.) 71,710.

CHISWICK. See BRENTFORD AND CHISWICK.

CHITA, *chí-tá'*, a city of the Soviet Union, and capital of Chita Region. Located on the Chita and Ingoda rivers and the Trans-Siberian Railroad, it is 2,625 feet above sea level. Founded in 1653, it had a population of 102,555 in 1939. It is the center of a rich mining region and industrial development. There are several technical colleges, a university, and a medical research institute located there; also the museum of The Russian Geographical Society.

CHITA REGION, an administrative division of the Soviet Union in Asia, 180,455 square miles in area and with a population in 1939 of 1,159,478. Its capital and chief city is Chita (q.v.); other cities are Nerchinsk and Sretensk. It is located on a plateau area with the Yablonoi

Mountains on the west and extensions of the various mountain ranges of the Khabarovsk Territory on the east. Partly an agricultural region, it produces cereals and vegetables and raises cattle. As a mining district, it produces coal, iron, and various metals. It also produces timber and furs. It is served by the Trans-Siberian Railroad in the south and by the new BAM trans-continental railway in the south and east. Formerly known as Transbaikalia, it was one of the earliest settled regions of eastern Siberia. After the 1917 revolution it was part of the Far Eastern Region, but in 1936 it became a new Soviet division.

CHITALDROOG, or **CHITALDRUG**, *chít'l-dröög*, a town in Mysore state, in the South Indian Union, 137 miles north of the city of Mysore. It is noted for its great fortress, which was unsuccessfully attacked by Haidar (Hyder) Ali in 1776, captured by him in 1779, and made the place of imprisonment of General Mathews by Tipu (Tippoo) Sahib in 1783.

CHITIN *kí-tín*, ($C_{15}H_{20}N_2O_{10}$), the horny substance which gives firmness to the tegumentary system and other parts of the Crustacea, Arachnida and insects; probably also the carapace of the *Rotatoria* consists of it. It is left when the above structures are exhausted successively with alcohol, ether, water, acetic acid and alkalis. It is colorless and amorphous, and is usually classed a proteid. It is dissolved by concentrated mineral acids without the production of color. It is not dissolved by solution of potash, even when boiling; neither does it give the characteristic reactions with Milton's or Schultze's tests.

CHITON, *kí'tôn* a genus of Mollusca and the common name of the same, the shells of which are boatshaped, and consist of a median series of symmetrical plates, folding over each other, and implanted in the mantle, the marginal zone of which is studded with spicules. It is the typical genus of the family Chitonidae of the class Amphineura. The chitons cling firmly to rocks, etc., by means of the powerful foot, many of them resisting the heaviest beat of the surf. Only very small species are found on the eastern Atlantic coast, but larger species occur in Florida and the Gulf of Mexico, while California has the giants of 8 or 10 inches of the genus *Cryptochiton*.

CHITON, *kí'tôn*, the undergarment of the ancient Greeks. In the earliest times it was worn by the men only; in later times there were two forms, and the chiton was worn by both sexes. The Dorian chiton was sleeveless, reaching about to the knees, and usually left more or less open on the right side. The Ionian was a long tunic reaching to the feet, closed on the sides, sometimes sleeveless, but often with short or long sleeves. Both forms were usually worn belted in at the waist.

CHITRAL, *chí-träl'*, Indian state, in the North-West Frontier Province, Pakistan. Through it flows in a southwest direction the Chitral or Kunar River, a tributary of the Kabul, and on it, at approximately latitude 36° north, stands the town of Chitral at a height of more than 5,000 feet above sea level. The people are Moslems, but

mostly speak a language closely akin to that of their neighbors in Kafiristan (eastern Afghanistan). Timber and minerals (iron, copper, lead, antimony) are the chief resources; sword blades, textiles, and fruit are shipped from the state.

Since the 17th century Chitral has been ruled by a Moslem dynasty bearing the title of mehtar. In 1895 a dispute over the succession to the throne, coupled with disturbances attendant on fixing the Afghan frontier, resulted in the siege of the capital, Chitral. From March 4 until they were relieved on April 19, the British political agent and a small body of troops held out against a force of Chitrali and Afghans. The state became part of Pakistan in 1947. It covers an area of 4,000 square miles. Pop. (1951) 107,000.

CHITTAGONG, chit'-a-gōng, the name of a city, district, and division in Pakistan.

(1) The city, in East Pakistan (East Bengal), on the Karnaphuli River about 12 miles from its mouth on the Bay of Bengal, and 225 miles east of Calcutta, India, is the capital of Chittagong Division. A leading port and rail terminus, it ships mainly jute, cotton, tea, rice, and hides. Though situated in an unhealthy climate (the annual rainfall is among the highest in the world), Chitral has developed rapidly in the 20th century and ranks as a port second only to Karachi in Pakistan. The city, once a pirate stronghold, was called by the Portuguese, who burned it in 1538, Porto Grande, still the name of its harbor. The British East India Company acquired it in 1760. Pop. (1951) 145,777.

(2) The district, which covers an area of 2,569 square miles, borders in the southeast on Burma and in the west on the Bay of Bengal. The fertile lowlands produce jute, sugarcane, tobacco, rice and other cereals, and vegetables. Tea is raised in the northern hills. The region fell to the raja of Arakan in the 16th century; in 1668 it was captured by the Mogul nawab of Bengal, and in 1760 it came under British control. A part of Bengal Province of British India, it became a section of East Bengal, Pakistan, in 1947. Pop. (1951) 2,321,000.

(3) The division comprises the districts of Chittagong, Tippera, Noakhali, Chittagong Hill Tracts, and Sylhet. It has a total area of 16,386 square miles. Pop. (1951) 11,836,000.

CHITTAGONG HILL TRACTS, district, Pakistan, situated in the Chittagong Division of East Pakistan (East Bengal). It has an area of 5,007 square miles. The capital is Rangamati, on the Karnaphuli River, linked by steamer with the city of Chittagong. Among the chief products are tea, rice, cotton, tobacco, sugarcane, and bamboo. Pop. (1951) 289,000.

CHITTAGONG WOOD, the name given to the wood of several Indian trees of the family Meliaceae (mahogany), and especially to *Chukrasia tabularis*. A light-colored, beautifully grained wood native to the Chittagong Hill Tracts, it is used for cabinetwork, although it does not wear too well in changeable climates. The name is also applied to the wood of *Toona ciliata*.

CHITTAMWOOD or **AMERICAN SMOKE TREE**, a species (*Cotinus obovatus*) of the cashew family, Anacardiaceae. It is a small tree with widespread branches attaining a height of about 30 feet, native to the rocky hills

of the Ozark region, southern Missouri to Oklahoma; and to central Texas, Alabama, and Tennessee. The orange-yellow heartwood yields a rich dye, and the timber is often used locally for fence posts because of its durability in contact with the soil. The common smoke tree, much cultivated, is *Cotinus coggygia*, a native of Eurasia. The species of the genus *Cotinus* have simple leaves in contrast to the typical pinnate form of the leaf of the sumac (*Rhus*), the latter being the principal American genus of this chiefly tropical family. The fruiting stalks of *Cotinus* have fine hairs which give the shrub or tree a smoky appearance after flowering, but in the American species these are rather inconspicuous.

Bumelia lanuginosa, a sapotaceous tree of the southeastern United States, is also known as chittamwood; and the bark of *Rhamnus purshiana*, the cascara buckthorn of the Pacific coast region, which yields cascara sagrada (q.v.), is called chittam (or chitem) bark.

CHITTENDEN, chit'-n-dēn, Hiram Martin, American military engineer and historian: b. Yorkshire, Cattaraugus County, N. Y., Oct. 25, 1858; d. Seattle, Wash., Oct. 9, 1917. After graduation from the United States Military Academy (1884), he rose through various grades to be lieutenant colonel of volunteers in the Spanish-American War. He retired as a brigadier general in 1910. An authority on water-control projects, he supervised government works in Yellowstone National Park and elsewhere, and published *The Yellowstone National Park: Historical and Descriptive* (1895); *The American Fur Trade of the Far West* (3 vols., 1902); *The History of Early Steamboat Navigation on the Missouri River* (1903); and *Flood Control* (1915).

CHITTENDEN, Russell Henry, American chemist and educator: b. New Haven, Conn., Feb. 18, 1856; d. there, Dec. 26, 1943. After being graduated from Sheffield Scientific School, Yale University, in 1875, he served as an assistant and instructor of chemistry there until 1878, when he went to Heidelberg, Germany, for further study. Returning to New Haven in 1879, he received his Ph.D. degree from Yale in the following year. He was appointed professor of physiological chemistry at the university in 1882, and from 1898 to 1922 served as director of the Sheffield Scientific School. Chittenden was the first to isolate glycocoll and glycogen in living tissue. His notable research was concerned principally with the biochemistry of digestion and nutrition. He edited *Studies in Physiological Chemistry* (4 vols., 1884; 1901). Among his other published works are *Digestive Proteolysis* (1895); *Physiological Economy in Nutrition* (1905); *The Nutrition of Man* (1907); *History of the Sheffield Scientific School* (2 vols., 1928); and *Development of Physiological Chemistry in the United States* (1930).

CHITTENDEN, Thomas, American public official: b. East Guilford, Conn., Jan. 6, 1730; d. Williston, Vt., Aug. 25, 1797. A leading resident of Salisbury, Conn., where he held various public offices, he moved in 1774 to Vermont, settling on the New Hampshire Grants and acquiring a fortune from his lands. With Ira Allen (q.v.), he drew up a constitution for Vermont, and in 1778 became its first governor, serving (except for the year 1789-1790) in this capacity until shortly

before his death. During the latter part of the Revolutionary War he made overtures to both the British and the Continental Congress in an endeavor to have the state's independence recognized.

His son, MARTIN CHITTENDEN (1763–1840), was also governor of Vermont, from 1813 to 1815.

CHITTIM. See KITTIM.

CHITTOOR, chīt-tōor', the name of a city and district in India.

(1) The city, about 90 miles west of Madras, serves as the capital of the district. It is the trading center of an agricultural region producing rice and oilseeds. Pop. (1941) 27,835.

(2) The district, an administrative division of the state of Madras, has an area of 5,951 square miles. Pop. (1951) 1,810,377.

CHITTUR, chīt'tōor, city, India, situated in an enclave of the state of Travancore-Cochin within the state of Madras, 38 miles east-north-east of Trichur. It has cotton gins, rice mills, and establishments producing tile and hand-woven cloth. Pop. (1941) 12,732.

CHITTY, chīt'i, Joseph, English legal writer: b. 1776; d. London, England, Feb. 17, 1841. Called to the bar in 1816, he practiced until 1833, when he retired because of ill health. He trained many lawyers and acquired a considerable reputation for his law manuals, including *A Treatise on Bills of Exchange* (1799); *A Treatise on the Law of Nations* (1812); *A Treatise on the Criminal Law* (1816); *A Treatise on Commercial Law* (1818); and *A Treatise on Medical Jurisprudence* (1834).

His four sons, also lawyers, were JOSEPH (d. 1838), author of *Chitty on Contracts* (1841); THOMAS (1802–1878), author of *Forms of Practical Proceedings* (1834); EDWARD (1804–1863), author of *Equity Index*; and THOMPSON (d. 1863).

His grandson, SIR JOSEPH WILLIAM CHITTY (1828–1899), son of Thomas, was called to the bar in 1856. He became a justice of the Chancery Division in 1881, and a lord justice of appeal in 1897.

CHIUSI, kyōō'sē (ancient CLUSIUM; Etruscan CHAMARS), commune, Italy, situated in Tuscany, in Siena Province, about 40 miles southeast of the city of Siena. A railroad junction and agricultural market, it stands on a hill 1,200 feet high, at the southern end of the Val di Chiana and 1.5 miles south of Lake Chiusi. The 12th century cathedral has a fine bell tower and contains many medieval inscriptions and a collection of 15th century illuminated manuscripts. The local museum houses only part of the wealth of artifacts excavated in the vicinity; large collections are in the Etruscan museums of Florence and Palermo. Near Chiusi is a vast necropolis, which testifies to the wealth and greatness of Etruscan Chamars. The tombs found there are of various kinds: round tombs with a cinerary urn in the center, from early times, when cremation was customary; chamber tombs hewn in the rocks, some of which are decorated with paintings and stone carvings, dating from the 6th century B.C. and after; and, from a later period, graves. Many, such as the Casuccini and Monkey tombs, contain several urns. While the earliest tombs contained only Etruscan artifacts, later ones yielded also objects imported from Greece, such as the famous *François Vase*,

the finest found at Chiusi. Mirrors, a variety of ornaments, and, in later tombs, thousands of bilingual Latin and Etruscan inscriptions were also found.

Chiusi came in contact with Rome at an early time. From there the semilegendary king, Lars Porsena, marched on Rome in the late 6th century B.C., and took the city to reinstate the Tarquins as kings. As one of the most powerful of the 12 Etruscan lucumonies, Chamars reached the zenith of its power and artistic development in the 5th century B.C. In the 4th century it was an ally of Rome, but a century later it was forced to submit to Roman rule. Pop. (1951) 8,641.

CHIVALRY, shiv'äl-rī (Old French *chevalerie*, from *chevalier*, horseman or knight), a term which indicates strictly the organization of knighthood in the Middle Ages, and, in a general sense, the spirit and aims which distinguished the knights of those times. Its chief characteristics were a warlike spirit, a lofty devotion to women, inspired by the widespread veneration of the Virgin Mary, a love of adventure, and a thirst for glory.

Under the feudal system the European peoples were united by some political ties, but they lacked that intimate connection which bound men together in the communities of antiquity, and the one strong bond of union was the Roman Catholic Church. The influence of a common religion was of great service during periods of turbulence, for it preserved the fabric of society. To this bond can be ascribed the great uniformity which prevailed during the ages of chivalry.

Development.—The chivalric character had not reached its full development in the age of Charlemagne. The courage displayed by the warriors of his time was that of individuals in bodies, and the independence which distinguished the knight-errant who sought adventures far and wide was the growth of a later period. By the 10th century knighthood had become an established and well-defined institution, but it was not until the 14th century that its honors were confined exclusively to the nobility. The Crusades gave a more religious quality to the spirit of chivalry, and they made the knights of the Christian countries known to each other, so that thereafter they exhibited great uniformity. Out of this period arose the great religious orders of knights (see ORDERS AND DECORATIONS). Gradually the whole establishment of knighthood assumed a more formal character. In the end it degenerated into quixotic extravagance, or dissipated its spirit in forms and punctilios.

Education of a Knight.—A boy of noble birth was sent at about his 12th year as a page to the court of some baron or knight, where he passed his time chiefly in attending the ladies and in acquiring skill in riding, in the use of arms, and in other accomplishments. When age and experience in the use of arms had qualified the page for war, he became a squire with, among other duties, that of carrying the shield of the knight whom he served. The third and highest rank of chivalry, that of knighthood, was not conferred before the 21st year except in cases of distinguished birth or great achievements. The individual prepared himself by confessing and fasting, and religious rites were performed. Then, after making a number of vows, including promises to be faithful, to protect women and orphans, never to lie or utter slander, and to live in harmony with his equals, he received the accolade. See also KNIGHT.

Influence.—In many respects, chivalry exercised a salutary influence at a time when conditions were unsettled and laws little regarded. Although it often carried the ideals of love and honor to an extreme, the reverence paid to them helped to prevent society, in a period of lawless violence, from relapsing into barbarism. Moreover it alleviated to some extent the evils of the feudal system. In the field of poetry the influence of chivalry was very great. The troubadours in the south of France, the trouvères in northern France, the minstrels in Great Britain and the minnesingers in Germany sang the deeds of the knights who received them hospitably. In Provence arose the courts of love (see COURT OF LOVE), which decided the poetical contests of the knights. In Germany the chivalric spirit produced the great epic of the *Nibelungenlied* (see NIBELUNGENLIED, THE). It was the spirit of chivalry which led to the Crusades, and from the intercourse with the Middle East which developed in this period the wonders of the Orient were introduced into chivalric poetry. This poetry existed apart from any influence of this kind, however, and really began with the cycle of King Arthur (see ARTURIAN ROMANCES, THE), which furnished materials that found poetic treatment in the various European countries. A second cycle is that of Charlemagne and his paladins, which remained a poetical foundation of chivalric poetry for many centuries. Alexander the Great also became a great hero of chivalric poetry (see ALEXANDER, ROMANCE OF). The *Amadis de Gaula* (q.v.), a prose romance which developed in Portugal and Spain, does not rest on any historical foundation.

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CHIVASSO, kê-väs'sô, commune, Italy, situated in Piedmont, in Torino Province, 13 miles northeast of Turin, at the junction of the Cavour Canal and the Po River. It is the market town for the cereals and hemp produced in the vicinity, and has steelworks, tanneries, and textile mills. The cathedral, begun in 1415, has a richly ornamented façade. An octagonal tower is all that remains of the palace of the marquesses of Montferrat, who ruled the town until 1431, when it passed to the house of Savoy. Pop. (1951) 12,652.

CHIVE or **CIVE**, a hardy perennial (*Allium schoenoprasum*), native to Europe and Asia, of the lily family (Liliaceae), which grows in compact tufts or clusters. The compact mass is formed by the intertangling of the fibrous roots. The leaves are very numerous, erect, slender, hollow, pointed, and deep green. The underground portion of the separate stems is slightly swollen and covered by a thin membrane. The tender young leaves are cut and used for seasoning soups, salads, stews, cottage cheese, and other foods.

The durable plants are frequently used for ornamental purposes and make an attractive border with their rose-purple flowers. The chive is readily grown from seed and propagates well by division of the clumps.

CHIVERS, chiv'ērz, **Thomas Holley**, American poet: b. near Washington, Ga., Oct. 18, 1809; d. Decatur, Ga., Dec. 18, 1858. After receiving

his M.D. degree from Transylvania University, Lexington, Ky., in 1830, he practiced medicine for a time but soon devoted himself entirely to writing. In 1845 he published a collection of poetry, *The Lost Pleiad and Other Poems*. It was followed by other volumes of verse, including *Virginiaia*, or *Songs of My Summer Nights* (1853) and *Atlanta, or the True Blessed Island of Poesy* (1853), and by a play, *The Sons of Usna: A Tragi-Apotheosis in Five Acts* (1858). Chivers, who knew Edgar Allan Poe well, shows affinities in his verse and aesthetic theories to the writings of his friend, and after the latter's death was accused of plagiarism. While this charge is still being debated, most critics agree that both poets were influenced by each other's works.

CHKALOV, ch'ká'lóf, **Valeri Pavlovich**, Soviet aviator: b. Orenburg, Russia, Feb. 2, 1904; d. near Moscow, Dec. 15, 1938. Trained as a pilot in the Soviet Air Force, he became a military test pilot and in 1935 received the Order of Lenin for his work in this field. In the following year he commanded a nonstop flight from Moscow to Nikolaevsk along a difficult Arctic route, proving the practicability of long-distance Arctic aviation. He served as chief pilot of a Soviet plane which made a pioneer nonstop flight of 5,670 miles from Moscow to Vancouver, Wash., via the North Pole in 1937. Killed in an accident while testing a new plane, he was given a state funeral and buried in the wall of the Kremlin. After his death the city and region of Orenburg, an island off Kamchatka, and several other places were named Chkalov in his honor.

CHKALOV (formerly called **ORENBURG**), city, USSR, situated in the Russian SFSR, on the Ural River, southwest of the Southern Urals and 236 miles southeast of Kuibyshev. The capital of Chkalov Region, it has large flour mills, an extensive light industry, and machine-building plants. The city, known as Orenburg until 1938, was founded in 1735 on the site of Orsk as a Cossack fortress, and was moved to its present location in 1743. It was the scene of heavy fighting during the revolution of 1917. Pop. (1939) 172,925.

CHKALOV REGION, administrative division, USSR, in the Russian SFSR, below and around the Southern Urals. Covering an area of 47,787 square miles, it is an almost treeless steppe crossed by the Ural and Samara rivers. Wheat and sunflowers are the chief crops. Cattle raising is important in the west, while the arid east has large herds of sheep and camels. Coal, iron, petroleum, oil-bearing shale, copper, nickel, phosphorites, and salt are mined, and refining, machine building, and food processing are the chief industries. The capital is Chkalov. Although the population includes various Asian peoples, Russians predominate. Pop. (1950) 1,800,000.

CHLADNI, kläd'nê, **Ernst Florens Friedrich**, German physicist: b. Wittenberg, Germany, Nov. 30, 1756; d. Breslau, April 3, 1827. Of Bohemian parentage, he was graduated from the University of Leipzig in 1782. Chladni is known chiefly for his pioneer work in acoustics, to which he was led by his interest in music. He showed that the communication of vibrations in material bodies is subject to constant mathematical laws (see also CHLADNI'S FIGURES). He also measured the velocity of sound in gases, and was one

of the first to demonstrate that meteorites could not have originated on earth. In addition, he invented two musical instruments, the euphonium and the clavicylinder. His published works include *Entdeckungen über die Theorie des Klanges* (1787); *Die Akustik* (1802); *Neue Beiträge zur Akustik* (1817); and *Über Feuermeteore und die mit denselben herabgefallen Massen* (1820).

CHLADNI'S FIGURES are figures made by sand on vibrating plates with free edges, indicating the position of the nodes. Their shape depends on the shape of the plate and the node in which it is made to vibrate.

CHLAMYPHORUS, klà-mif'ò-rüs, or **CHLAMYDOPHORUS**, a genus of armadillos, the nearest relative of which is *Burmeisteria*. There is one species, *C. truncatus*, the pichiciego. The length of head and body without the pelvic shield and tail is about four inches. The eyes are small, and there is virtually no external ear. The dorsal shield, composed of some 25 pointed plates, which is closely articulated with the head shield, is attached to the trunk only along the median line of the back. Posteriorly, it ends abruptly, and the rear end of the body is closed by a bony pelvic shield through the lower part of which the stiff tail, with a flattened tip, projects. The entire body is clad with a thin coat of very fine, silky white hairs. There are two pectoral mammae, and two young are said to be born. In *Acta Zoologica Lilloana* (vol. 3, 1945), Dr. J. D. L. Minoprio of Argentina shows a photograph of the animal's sleeping position: the back greatly arched upward, bringing the head and pelvic shield close together, so that the body appears to rest on head and tail. In this position the forefeet seem to act as balancers. The pichiciego is reputed to be nocturnal and to feed almost entirely on worms and insects. It digs its burrows with great rapidity in the sandy waste places of Mendoza Province, Argentina. Three subspecies, *truncatus*, *palquiensis*, and *menor*, are recognized by Minoprio.

CHLAMYS, klà'mis, in costume, a light and freely flowing mantle or cloak worn as an outer garment in ancient Greece. It was oblong in shape, generally twice as long as its width, and was fastened either in front or at the shoulder. The chlamys worn by the young man was probably yellow, while that of the soldier was scarlet.

In zoology, it is the name of a genus of coleopterous insects belonging to the family Chrysomelidae. There are only a few North American species, none of which is of large size.

CHLIDANTHUS, klì-dán'thüs, a genus of two tropical American, lilylike plants belonging to the amaryllis family. The leaves are linear and basal, and the bright yellow, fragrant flowers are borne in umbels on erect scapes. *C. fragrans* is rather commonly cultivated.

CHLOASMA, klò-äz'mà, a deposit of pigment in the skin, occurring in patches of varying sizes and shapes. These patches may be yellow, brown, or black in color. The condition is often associated with derangement of the endocrine system. If the pigment is melanin, the chloasma is known as melanosis. The general condition of chloasma is often due to irritation of the skin caused by exposure to the sun's rays, or by the

action of mechanical, chemical, or infectious agents. Chronic irritation of the skin from dust, sweat, and vermin may produce the condition known as vagabond's disease. The pigment present in Addison's disease is a true melanosis. Other examples are freckles and pigmented nevi. Occasionally carcinoma arises from a pigmented nevus regarded as a harmless mole. As a rule, melanosis is in fact harmless and requires no treatment beyond removal of the exciting cause, if it can be found.

HAROLD WELLINGTON JONES, M.D.

CHLOPICKI, klò-pëts'kè, Józef, Polish general: b. Galicia, March 14, 1771; d. Kraków, Sept. 30, 1854. At the age of 16, he joined the Polish Army, and in 1794 served under Thaddeus Kosciuszko in the rebellion following the second partition of Poland. Entering the service of Napoleon, he fought in Italy and Spain and took part in the battles of Eylau, Friedland, and Smolensk. Returning to Poland after the fall of Napoleon, he joined the Russian Army, in which he served until 1818. At the outbreak of the Polish Revolution of 1830, he was chosen dictator, but soon resigned because of his opposition to the policies of the revolutionary leaders and joined the army fighting the Russians. Wounded in February 1831, he retired to Kraków.

CHLORAL, klò'räl, the common name for trichloroacetaldehyde, $\text{Cl}_3\text{C}-\text{CHO}$. It is a colorless liquid which freezes at -58.5°C ., and boils with some decomposition at around 97.5°C . Chloral is made commercially by the chlorination of ethyl alcohol, $\text{C}_2\text{H}_5\text{OH}$. The reaction takes place in a series of steps involving the oxidation of alcohol to acetaldehyde, polymerization to paraldehyde, and chlorination. In the batch process chlorine is passed slowly over ethyl alcohol until the product attains a density of around 1.5. A continuous process involves the employment of a series of kettles with increasing temperatures from one to the next. Chloral alcoholate, an addition product, is broken up by sulphuric acid, and the chloral vaporized from the mixture. Another process involves the electrolytic oxidation of alcohol in the presence of potassium chloride. Acetaldehyde may be chlorinated directly.

About 3 million pounds of chloral are produced annually in the United States. Its chief industrial use is in the synthesis of the insecticide commonly known as DDT. This material has as its chief constituent dichlorodiphenyl-trichloroethane, $\text{Cl}_2\text{C}-\text{CH}(\text{C}_6\text{H}_4\text{Cl})_2$. The chlorine atom on each benzene ring is in the para position.

Chloral reacts with sodium hydroxide to yield chloroform and sodium formate, $\text{Cl}_3\text{C}-\text{CHO} + \text{NaOH} = \text{CHCl}_3 + \text{HCO}_2\text{Na}$. This reaction is thought to have suggested the possibility of producing an anesthetic, or at least a hypnotic, from chloral.

Chloral Hydrate.—Chloral has the power of adding a variety of compounds, of which water is the most important. Chloral hydrate has the formula $\text{Cl}_3\text{C}-\text{CH}(\text{OH})_2$, and is particularly interesting to organic chemists because it is a very rare example of a stable compound in which two hydroxyl groups exist on a single carbon. Carbonic acid has the formula $\text{O}=\text{C}(\text{OH})_2$, but it can exist only in water solution. The presence of the three strongly negative chlorine atoms on the adjacent carbon is thought to be the reason for the relative stability of chloral

hydrate. This substance, a crystalline solid melting at 50°C., was formerly used very extensively in medicine as a soporific, but with the introduction of much safer sleep-producing substances, such as the barbiturates, chloral hydrate has practically disappeared from among pharmaceuticals. It is very irritating to the stomach, fatal in overdoses, and also very habit forming.

Other Additives and Derivatives.—Other chloral additives are chloral alcoholate, chloral ammonia, chloral caffeine, chloralformamide, and chloralimide. A somewhat similar substance is butyl chloral, 2,2,3 chlorobutanol, $\text{CH}_3\text{CH}(\text{Cl})\text{CH}_2\text{CHO}$, which is used in medicine as a sedative.

Two chloral derivatives which are used as substitutes for chloral hydrate are sometimes mistaken for each other because of the similarity of their common names. The one, chloralformamide, is also incorrectly called chloralimide. The other is chloralimide. The formula of chloralformamide is $\text{Cl}_3\text{C}-\text{CHOH}-\text{NHCHO}$, while that of chloralimide is $(\text{Cl}_3\text{C}-\text{CH}=\text{NH})_2$. The former is said to be slower and safer in its action as a soporific than chloral hydrate. Chloralimide, which is prepared by the reaction between chloral and ammonium chloride, is a tasteless, odorless crystalline material, employed as an antipyretic and analgesic.

W. T. READ,
Research and Development Division, General Staff, Department of the Army.

CHLORAL HYDRATE. See **CHLORAL**.

CHLORAMPHENICOL. See **ANTIBIOTICS**.

CHLORASTROLITE, klōr-ās'trō-lit, a mineral found in the form of rounded pebbles of radiated structure on the shores of Isle Royale, Lake Superior, and derived from the traprock in the vicinity. It is bluish green in color, with a hardness of 5.5 and a specific gravity of 3.18, and can be given a high polish. Some authorities consider it to be an impure variety of prehnite, but optical considerations have led to the view that it should be classed under thomsonite.

CHLORATES, klō'rätz, the metallic salts of chloric acid. They are all more or less soluble in water, potassium chlorate being least soluble. All of them are decomposed by heat, with the evolution of oxygen. See also **CHLORIC ACID**.

CHLORIC ACID, klō'rīk, a colorless, strongly acid liquid, having the formula HClO_3 , and a specific gravity of 1.28. It combines with bases to produce the salts known as chlorates. Potassium chlorate is formed directly when chlorine gas is passed through a warm, concentrated solution of caustic potash. By treating this salt with sulphate of ammonia and adding barium hydrate, barium chlorate, $\text{Ba}(\text{ClO}_3)_2$, is formed; from it chloric acid is set free by the action of dilute sulphuric acid. The clear solution is decanted from the precipitated barium sulphate and evaporated over strong sulphuric acid in a vacuum until the residue contains 40 per cent of pure chloric acid. A further concentration leads to decomposition. This aqueous acid is colorless and has a pungent odor and a sour taste. When exposed for a time to the light, it changes to perchloric acid. Because of the facility with which it parts with its oxygen, chloric acid has power-

ful bleaching properties. Paper dipped into a strong solution of the acid takes fire spontaneously on drying owing to the great rapidity of its oxidation. The most important salt of chloric acid is potassium chlorate, which is used in the preparation of oxygen gas, the manufacture of matches, and medicine. It crystallizes in monoclinic plates with a specific gravity of 2.35.

CHLORIDES. See **HYDROCHLORIC ACID**.

CHLORIMETRY or **CHLOROMETRY**, the art of estimating the quantity of chlorine in bleaching powder or other hypochlorite.

CHLORINE, klō'rēn, a readily liquefied, greenish yellow gas. As a gas, under room conditions, it is about two and one-half times as heavy as air. As a liquid, it is shipped in steel cylinders or tanks at 150 pounds per square inch, and is about 35 to 40 per cent heavier than water. Its boiling point at atmospheric pressure is 34°C. below zero (29.2°F. below zero); its melting point, about 100°C. below zero (148°F. below zero). Chlorine is an element (in the chemical sense) with the symbol Cl , atomic number 17, and atomic weight of 35.457. It is second to the lightest in the group of four elements known as the halogens (see **HALOGEN**), all of which have analogous acidic, or salt-forming, properties.

Chlorine is actually a mixture of essentially two isotopes, consisting of about 75 per cent and 25 per cent chlorines of nearly 35 and 37 atomic weight, respectively. In addition, radioactive (synthetic) isotopes of atomic weight 33, 34, 36, and 38 have the atomic configuration of chlorine.

The element is one of about a dozen heavy chemicals of major industrial importance. It is also one of a very small number of industrial chemicals of tonnage importance (aside from metals) which are shipped and sold in the elemental state.

Historical Development.—The discovery of chlorine is usually attributed to the great Swedish chemist Karl Wilhelm Scheele (q.v.), in 1774. He named it "dephlogisticated marine acid air," a conception which visualized chlorine as an oxidized form of a part of sea (common) salt. Antoine Laurent Lavoisier also considered it an oxidized gas, but Sir Humphrey Davy (qq.v.) showed that the substance was not a compound of oxygen but a simple substance or element, and because of its peculiar yellowish-green color he gave it the name "chlorine," from the Greek *chlōros*.

For about 100 years after its discovery chlorine had little industrial importance, but by the latter part of the 19th century the Weldon and Deacon processes for producing it by chemical reactions were operated commercially. Both of these processes oxidized as the raw material hydrogen chloride, which was obtained from the treatment of salt with sulphuric acid. In the first process oxidation was conducted with manganese dioxide; the second used air with a copper chloride catalyst. In both processes the chlorine gas was dilute but was suitable for making bleaching powder, which then served as the principal method of transporting the product.

Early in the 20th century the development of direct-current generating equipment made the electrolytic method of preparing nearly pure chlorine commercially feasible. The element then

developed with phenomenal rapidity as one of great industrial importance. During the first half of the 20th century the production of chlorine grew by leaps and bounds, much faster than the rate of general industrial progress and even faster than that of the chemical industry as a whole. Toward the end of World War II, the annual United States consumption of chlorine was approximately 20 pounds per capita; German consumption, about 15 pounds; and Japanese, about 2 pounds. In the mid-1950's the element was being shipped in the United States in trainload lots, and there were also a number of high-capacity barges in use. In addition, substantial quantities were being shipped by pipeline from supplier to consumer.

Source.—The ultimate source of practically all of the chlorine of commerce is common salt, or sodium chloride, which is very widely distributed in nature. Most of the chlorine produced in the United States by the electrolysis of common salt is obtained by the direct treatment of a saturated or nearly saturated brine. Despite the extremely rapid growth of the demand for and uses of chlorine, the demand for sodium products is still higher, so that most of the chlorine mined with salt is unused. Furthermore, the utilization of chlorine is not, generally speaking, at its highest efficiency. In the manufacture of most chlorinated chemicals by the direct use of chlorine, there is formed much hydrogen chloride, which is sold at low prices.

Manufacture.—The first half of the 20th century saw an intensive development of the electrolytic cells used for the manufacture of chlorine. Two general types of cells in common use are the diaphragm cell, which uses a diaphragm to separate gaseous chlorine from gaseous hydrogen; and the mercury cathode cell, which forms a sodium amalgam which is reacted with water to caustic soda and hydrogen in a separate chamber. About two thirds of the approximately 350 patents which have been issued in the United States on caustic and chlorine cells have been issued on diaphragm cells, and one third on mercury cells. Of all these patents less than one tenth (when considering distinct types) have been reduced to commercial practice, and of those so reduced only about half have been able to survive the combination of engineering imperfection, insufficient capital, and unfavorable operating or business conditions. As of 1953, approximately 120 chlorine factories (including some 65 in the United States) were conducting reasonably profitable operations.

Hazards.—Although chlorine is toxic, its extremely pungent and disagreeable odor has resulted in the fact that there have been substantially no fatalities, and relatively few serious accidents, in connection with its widespread production and use. Chlorine attacks the mucous membranes of the nose and throat, and when small quantities are breathed for some time, an irritating cough accompanied by bloody sputum develops. When breathed in considerable quantities, it causes serious congestion of lung tissue, which, in extreme cases, may be fatal.

A few parts of chlorine per million in the atmosphere are detected by most human olfactory nerves, but this concentration is safe almost indefinitely. About twice the concentration just barely detectable is oppressive to most persons. Four parts per million can be borne without severe effect for one-half to one hour; a concen-

tration of 50 to 60 parts per million causes dangerous illness in the same period. Activated charcoal gas masks, which are commonly available in all chlorine plants and in places where chlorine is used, offer full protection.

One of the biggest hazards in connection with chlorine is the fact that mixtures of it with hydrogen are extremely explosive. Moreover, some of the nitrogen compounds of chlorine are readily detonated by shock. Despite these hazardous characteristics, however, both the producing and the consuming industries in the United States can be said to have an enviable safety record.

Uses.—Chlorine (including such forms as several types of bleaching powder, sodium chlorites, and chlorine dioxide, etc.) is a very widely used bleaching agent. In particular, the bleaching of wood and other vegetable pulp, especially kraft pulp, uses large tonnages of chlorine. The digestion of such fibrous materials as bamboo and straw, in which the action is more than merely bleaching, produces high-grade paper raw materials. With minor exceptions, chlorine is too destructive to use in bleaching wool, silk, and other products of animal origin, such as feathers.

Probably the fastest growing use of chlorine is in the manufacture of many organic, and some inorganic, compounds containing chlorine. In this respect, the element can be considered one of the most powerful tools in the synthetic chemical industry. Chlorinated products are adapted to a wide variety of end uses. Among the organic products are chlorinated (fireproof) solvents from acetylene and ethylene; trichloroethylene; carbon tetrachloride (fire extinguisher and solvent); chlorobenzenes and chlorotoluenes; ethylene glycol; antiknock fluids; synthetic plastics; synthetic rubbers; refrigerants; lubricant additives; chlorinated naphthalene; agricultural chemicals, such as insecticides and weed killers; intermediates; and miscellaneous products. Among the inorganic products are bromine (for antiknock fluids and photographic chemicals); hydrogen chloride and hydrochloric acid; metallic chlorides for the metallurgical and general chemical fields; sulphur monochloride and dichloride; phosphorus trichloride and pentachloride; and a host of oxidizing and bleaching compounds.

The metallurgical uses of chlorine include various methods for the extraction of copper, lead, zinc, nickel, gold, platinum, silver, titanium, tungsten, and vanadium.

One of the most important uses of chlorine is in sanitation. The purification of drinking water and the sterilization of sewage effluents consume a significant fraction of chlorine—one of much greater importance than its quantity might indicate. Many household disinfectants represent similar end use of chlorine. Chlorine is a very powerful bactericide, and as an algicide it is extremely effective when used in periodic doses.

Coproducts.—A number of important industrial chemicals are produced as coproducts with chlorine. Sodium or potassium hydroxide and hydrogen are produced by the electrolysis of the corresponding chloride brines. Metallic sodium, metallic magnesium, and, to a small extent, calcium and lithium are produced by the electrolysis of the corresponding fused chlorides. Sodium nitrate is produced as a coproduct in the treatment of common salt with nitric acid. In fact, the most important of the coproducts is sodium hydroxide or caustic soda, which is a coproduct of approximately three fourths of the

chlorine used commercially in the United States.
Z. G. DEUTSCH,
Deutsch and Loonam, Consulting Engineers and Metallurgists.

CHLORIS, klô'ris, the name of three characters in Greek mythology.

(1) The goddess of flowers and the wife of Zephyrus, identical with the Roman Flora.

(2) The daughter of Amphion of Orchomenus. She was the wife of Neleus and the mother of Nestor.

(3) The daughter of Niobe and of Amphion of Thebes. When the children of Niobe were killed, she and her brother Amyclas alone escaped, and she became so pale from terror that her name was changed to Chloris, meaning "yellowish green."

CHLORITE GROUP, klô'rit, in mineralogy, a group of minerals crystallizing in the monoclinic system, exhibiting a green color from the presence of ferrous iron, and chemically definable as hydrous silicates of aluminum, ferrous iron, and magnesium. They are usually secondary minerals, derived from pyroxene, amphibole, and other forms. Although they exhibit a marked basal cleavage suggestive of mica, they differ from mica and its allies by not containing any considerable amounts of calcium or of the alkalis.

CHLORITE SCHIST. As chlorite is a general name for green, secondary, hydrated silicates containing aluminum and iron (see **CHLORITE GROUP**), so chlorite is used as a prefix to various names of rocks that contain such silicates, as in chlorite schist. In the wide belt of Algonkian and Archean rocks stretching from Labrador to the western end of Lake Superior there are great areas of chlorite schists resulting from the alteration of sedimentary and igneous rocks.

CHLOROFORM, klô'rô-fôrm, trichloromethane (formula CHCl_3), a heavy, colorless liquid having a sweet, burning taste and a characteristic ethereal odor. Commercial chloroform contains up to 2 per cent by volume of alcohol. It may be formed by the action of caustic potash on chloral and, on a large scale, by distilling water and alcohol with chloride of lime. It boils at 61°C ., and at 25°C . has a specific gravity of 1.476, dissolving in 210 volumes of water. It should be kept in light-resistant containers at a temperature below 30°C . Chloroform is used as an organic solvent and as an anesthetic, anodyne, and antispasmodic. As a general anesthetic, it is more powerful and quicker in action than ether (q.v.), but in unskilled hands is much more dangerous. Occasionally it is administered by the mouth as a carminative. It is also used in liniments, since it is a powerful skin irritant. If given in large doses internally, it is dangerous.

Chloroform was discovered independently by Samuel Guthrie (1782-1848) of Sackett Harbor, N. Y., who produced it by distillation; Eugène Soubeiran (1793-1858) of Paris, France; and Baron Justus von Liebig (1803-1873) of Giessen, Germany, the discoverer of chloral. The three men published their work in 1831-1832, and are accorded equal honor. The anesthetic value of chloroform was discovered in 1847 by Sir James Young Simpson (1811-1870), and its further use on a scientific and popular basis was developed by John Snow (1813-1858).

When it is inhaled, chloroform is absorbed rapidly through the mucous membrane of the respiratory tract. When given by mouth, it causes irritation of the gastrointestinal mucosa, and its absorption is rapid. During anesthesia chloroform acts successively on the cerebrum, cerebellum, and the sensory and motor sides of the spinal cord. This action first causes sleep and then, in succession, loss of sensibility, loss of reflexes, muscular relaxation, and respiratory and vasomotor paralysis. The action of chloroform is quite similar to that of ether, but several times the quantity of ether is required to produce the effects of chloroform anesthesia.

Since it is some eight times as powerful as ether, chloroform is a definite circulatory depressant, and herein lies its greatest danger. The depressant action is caused principally by the effects of the drug on the vasomotor center and the blood vessels rather than on the heart itself. When it is inhaled, chloroform is eliminated rapidly by the body, about half the quantity administered leaving the system within 30 minutes. The drug causes very considerable metabolic disturbances, such as acetoneuria and acidosis. Untoward effects and acute poisoning occasionally result from the use of chloroform, and, despite the contrary impression prevailing, children are as vulnerable as adults. Sudden death has occurred after a few whiffs of the anesthetic, or following short but painful operations (such as tooth extractions) when the anesthesia has been incomplete or imperfect. The margin of safety between the anesthetic dose and the lethal dose is a narrow one. Early signs of collapse in chloroform anesthesia are usually well marked, and are shown by increasing pallor, respiratory failure with short and inefficient expiration, gasping, irregular and broken inspiration, and great dilatation of the pupils. In fatal cases the patient suddenly becomes deathly pale as the heartbeat ceases. The real value of chloroform as an anesthetic lies in its analgesic and antispasmodic properties when it is inhaled in small quantities. Despite its usefulness it has been largely superseded by ether. In the convulsions of tetanus and rabies, however, and in renal and biliary colic, when morphine is unavailable or contraindicated, chloroform is sometimes a source of great relief.

The most important preparations of chloroform are the pure drug (99.5 per cent chloroform to 0.5 per cent alcohol), spirits of chloroform, and chloroform liniment. See also **ANAESTHESIA**.

HAROLD WELLINGTON JONES, M.D.

CHLOROMYCETIN. See **ANTIBIOTICS**.

CHLOROPHANE, klô'rô-fân, in mineralogy, a variety of fluorspar, or fluorite, which, when warmed, shines with a green phosphorescent light. Fine specimens are found in Trumbull, Conn., and in the mica mines of Amelia County, Va.

CHLOROPHYCEAE, klô-rô-fî'sê-ê, a class of the lower plants commonly known as the green algae. The Chlorophyceae are especially characterized by their grass-green color, which is due to the abundance of chlorophyll (q.v.) present in chloroplasts (see **CHLOROPLAST**) in association with small quantities of carotene (orange) and xanthophyll (yellow) pigments. Starch is present as a result of photosynthetic activity, and oil may occur as a storage product.

Body Types.—The Chlorophyceae are repre-

sented by a wide range of body types. The simplest ones are single cells, which may be nonmotile (as in *Chlorella*), or motile either by flagella (as in *Chlamydomonas*) or by the secretion of mucilage (as in the desmids). Some organisms are composed of many cells arranged in loosely organized colonies (*Tetraspora*); other colonial forms (*Volvox*) have a more definite pattern of organization with some evidence of division of labor among the cells of a single colony. Still other Chlorophyceae are in the form of filaments (*Spirogyra*, *Stigeocolonium*), cylinders (*Enteromorpha*), or sheets (*Ulva*). Both uninucleate and multinucleate cells are found among the members of the Chlorophyceae. Nuclear division without subsequent division of the cell body has resulted, in some cases, in a tubular structure containing many nuclei and few, if any, septa. The tubes are often interwoven to form large plant bodies of striking appearance (*Penicillus*, *Caulerpa*).

Reproduction.—Asexual reproduction is accomplished by vegetative cell division or by the internal production of spores, which may be motile (zoospores) or nonmotile (aplanospores). Zoospores are commonly motile by means of two or four flagella of equal length inserted on the anterior end of the cell body; a few genera have zoospores with a crown of flagella. Sexual reproduction is widespread throughout the Chlorophyceae and is always effected through the union of two gametes. The gametes may be derived from the same parental strain (homothallism) or from different parental strains (heterothallism). The fusing gametes may both be motile and of equal size (isogamy) or unequal size (heterogamy), or one gamete may be motile and the other nonmotile (oögamy). Isogametes are often morphologically identical with zoospores and may function as asexual spores, if the opportunity for sexual fusion does not present itself. The complexity of the sexual process bears little relation to the type of plant body, inasmuch as all grades of sexual reproduction are found repeatedly in unicellular, colonial, and filamentous series. The nuclei of most Chlorophyceae (*Chlamydomonas*, *Spirogyra*) are haploid, the only diploid nucleus being in the zygote; some (especially the siphonaceous forms) are diploid, however, reduction in chromosome number occurring in the formation of gametes. In a few species (*Stigeocolonium*, *Cladophora subriana*) there is an alternation of a haploid, gamete-producing plant with a diploid, spore-producing plant.

Habitat.—The majority of the Chlorophyceae live in fresh water, but some (especially the siphonaceous forms) are marine. Many Chlorophyceae are common constituents of the soil flora, while others (notably *Protococcus*) are subaerial, occurring in such numbers as to color green the damp surfaces of tree trunks, stone, and brick and cement walls. Certain other Chlorophyceae form lichens in association with fungi.

Importance.—The Chlorophyceae are an important link in the natural food chain, supplying many microscopic animals with a source of food. Mass cultures of green algae are being investigated as a possible direct food source for cattle and other animals, and even for man. Scientific investigations in genetics, ecology, physiology, biophysics, and biochemistry have all profited in their use of the Chlorophyceae as research organisms. See also ALGAE.

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G. M., *Fresh-water Algae of the United States*, 2d ed. (New York 1950).

RICHARD C. STARR,
Department of Botany, Indiana University.

CHLOROPHYLL is the green pigment by which plants mediate the process of photosynthesis (q.v.). It absorbs the light energy which is used in the reduction of carbon dioxide to sugars and other plant materials.

That chlorophyll is essential to photosynthesis can be shown in a number of simple ways. In the first place, the nongreen portions of variegated leaves and the nongreen leaves of variegated plants do not carry on photosynthesis. It is also possible to show that photosynthesis takes place within the cells of the leaf only when the light falls directly on the chlorophyll-containing bodies, the chloroplasts. Comparison of the absorption spectrum (the colors of light absorbed) of chlorophyll with the effectiveness of these colors in inducing photosynthesis by the leaf confirms the essentiality of chlorophyll to the photosynthetic process.

The chlorophyll of the plant cell is all contained in minute particles called grana, which are of the order of 1 micron in diameter, are disc shaped, and are formed in turn of successive thin layers. The component layers are made up of protein to which is attached chlorophyll and other substances, including the yellow carotenoids. Roughly 8 per cent of the dry weight of each granum is composed of chlorophyll, 50 per cent or more is protein, and the remainder is shared among a great variety of further constituents. In order to be effective in photosynthesis, the chlorophyll must be attached to the granum protein, and it is generally supposed that this protein contains other components essential to the photosynthetic process. The grana are associated together in chloroplasts, special bodies each containing 10-100 grana and each surrounded by a limiting membrane. Chloroplasts are of many different shapes and may be saucer-like, flat, granular, or spiral (see also CHLOROPLAST).

Chemically speaking, chlorophyll is a porphyrin, a structure composed of four simple pyrrole rings (each containing four carbon atoms and one nitrogen atom) joined through carbon bridges. It is distinguished from other porphyrins which occur in nature by (1) the magnesium atom which is bound in the center of the chlorophyll porphyrin ring, and (2) the long-chain phytol group which is bound to the porphyrin. Chlorophyll is characterized, too, by the number and nature of the simpler chains arranged around the periphery of the porphyrin nucleus. Higher plants (seed plants), in fact, ordinarily contain two chlorophylls, known as chlorophyll a and chlorophyll b, which differ from one another in the arrangement of their peripheral groups. Chlorophyll a, the more abundant form, possesses a CH_3 or methyl group, at a particular position at which chlorophyll b contains an aldehydic group.

The absorption spectrum of chlorophyll is characterized by a sharp peak in the blue region of the spectrum, between 4250 and 4750 angstroms. Chlorophyll possesses a second absorption maximum in the red end of the spectrum, a peak between 6500 and 7000 angstroms. Chlorophylls a and b may be distinguished by the small differences in their absorption spectra. The green color of chlorophyll is due to the fact that the chlorophyll molecule absorbs both red and blue,

but permits the green portion of the spectrum to pass through largely unabsorbed, and therefore visible to the eye.

J. F. BONNER,

Professor of Biology, California Institute of Technology.

CHLOROPHYLLITE, klō-rō-fil'it, an alteration product of the mineral iolite (q.v.). The only difference in composition is a larger percentage of water, but there is a marked decrease in hardness from the range of iolite of from 7 to 7.5 to that of chlorophyllite of from 1.5 to 3. There is also a difference in transparency. The characteristic blue color of iolite is changed to a dull green, and a basal cleavage is highly developed. Its specific gravity is 2.7. It is found at Unity, N. H.

CHLOROPICRIN, klō-rō-pīk'rīn, a heavy, colorless, pungent-smelling liquid, obtained by subjecting picric acid (q.v.) to the action of chlorine; hence it is also called nitrochloroform. Its vapor causes vomiting; thus it is sometimes called vomiting gas. Its vapor also irritates the eyes. Its chemical formula is CCl_3NO_2 . It is readily soluble in alcohol but not in water. High concentrations of the gas used in warfare have caused death.

CHLOROPLAST, klō-rō-plāst. The chlorophyll (q.v.) or green coloring matter of plant cells is not diffused throughout their mass, but is collected in certain special bodies known as *chloroplasts*. These chloroplasts may be of the most varied shapes; they may be granular, as is the case in most flowering plants, or spiral bands, as in *Spirogyra*, or flat plates, as in *Mesocarpus*. They contain particles of nutritive material in the form of starch-grains, oil-drops, and highly-refractive masses of proteid known as *pyrenoids*.

Bodies of the same general character as chloroplasts, but differing from them in the absence of chlorophyll, are known as *leucoplasts* or *chromoplasts* according as they are colorless or pigmented. Chloroplasts, leucoplasts and chromoplasts are all known as *chromatophores*. In all embryonal cells, all the chromatophores have the appearance of leucoplasts, being small, transparent, highly-refractive bodies of granular, spindle-like, or thread-like form. It is because of this common origin that the chromatophores, or as they are also called, *plastids*, are classed together under a single heading.

In those phanerogams that lack a green color, the chloroplasts are replaced by other chromatophores. In the fungi, however, which likewise lack chlorophyll, there are no chromatophores of any sort. The chromatophores of the blue-green, red and brown algae contain chlorophyll, but in addition other pigments, known as phycocyan in the blue-green algae, phycoerythrin in the red algae, and fucoxanthin in the brown algae.

The chloroplast, as the chlorophyll-bearing organ, is undoubtedly that part of the cell which is most directly concerned in the assimilation of carbon dioxide. This process is very imperfectly understood, but is believed to involve the action of an enzyme. (See CHLOROPHYLL).

Ponomarew claims that the chloroplast is liquid, and of a colloidal nature. He explains its relative permanency of shape by supposing that it is in equilibrium with the surrounding

cell-contents as to surface-tension. He accounts for the contraction of the chloroplast into a spherical shape when the cell is treated with dilute alcohol as due to a disturbance of this equilibrium.

In most plants the chloroplasts are sensitive to light, and place themselves in the cell in such a manner as to offer the greatest surface possible to a slight illumination, but the least surface possible to an intense illumination. Thus the plate-like chloroplast of *Mesocarpus* presents its face to a weak light, its edge to a strong one. The chloroplasts of *Lemna trisulca* group themselves in planes parallel to the surface of the leaf when moderately illuminated, but perpendicular thereto if the illumination be intense. In all cases the position in the dark is less definitely determined. On account of these light-reactions of the chloroplasts, the suggestion has been made that they act in a manner analogous to sense-organs, but this idea of a specific sensitivity on their part was opposed by Pfeffer.

CHLOROSIS, klō-rō'sīs, is not now regarded as a separate disease but rather as a normal tendency toward anemia in adolescent girls due to rapid growth and food deficiencies. First described by Johann Lange (1485-1565) of Basel in 1554, it was given its name *De morbo virgineo*, or sickness of young girls. Its existence was recognized as extremely common in girls' boarding schools and among domestic servants. As early as 1837 it was known to be associated with a deficiency of iron in the blood. Chlorosis is observed in young women between the age of puberty and twenty-five. It is characterized by anemia, usually with a lowered red blood cell count, the cells being considerably reduced in size, as a rule, and with an extremely low hemoglobin content. The cells themselves, in stained specimens, appear as rings. Persons affected exhibit a greenish pallor, especially about the eyes and chin, from which the disease receives its name, "green sickness." There are also present the usual signs of severe anemia such as breathlessness, irritability, and edema of the ankles, as well as digestive disturbances, capricious appetite, constipation, and lessened menstrual flow. It is thought that in former years many cases of duodenal ulcer and early tuberculosis in anemic young women were classed as chlorosis. The malady has all but disappeared and only occasional cases have been reported in recent years. As a clinical entity chlorosis is no longer of importance.

HAROLD WELLINGTON JONES, M.D.

CHLOROXYLON, a genus of plants of the family Meliaceae, distinguished by the fact that the fruit has only three cells and is split into three parts. The satinwood tree of India, *Chloroxylon swietenia*, sometimes grows to a height of 50 or 60 feet and is a native of Ceylon and the Coromandel coast. The wood is hard and light-colored, having a satin-like luster and is sometimes cotted or curled, somewhat resembling boxwood but deeper in color. It is mainly used for articles of turnery and cabinetwork.

CHLORTETRACYCLINE. See ANTI-BIOTICS.

CHMEL, kměl, Joseph, Austrian historian: b. Olmütz, March 18, 1798; d. Vienna, Nov. 28,

1858. In 1846 he was appointed vice director of the Vienna State Archives. He edited the following works: *Regesta chronologico-diplomatica Rupertii regis Romanorum* (Frankfurt am Main 1834); *Die Handschriften der kaiserlich-königlichen Hofbibliothek in Wien*, 2 vols. (Vienna 1840-41); *Urkunden, Briefe und Aktenstücke zur Geschichte Maximilians und seiner Zeit* (Stuttgart 1845); *Aktenstücke und Briefe zur Geschichte des Hauses Habsburg im Zeitalter Maximilians I, Monumenta Habsburgica*, vol. 1 (Vienna 1854); *Regesta chronologico-diplomatica Friderici III*, 2 vols. (Vienna 1859).

CHMELNIZKIJ, kmél-nít'skê, **Nikolai Ivanovich**, Russian playwright: b. 1789; d. St. Petersburg, 1845. He contributed largely to the reformation and elevation of the Russian stage. His works include *The Word of the Tsar*; *Russian Faust*; *The Babblers*; *Air Castles*; *The Waverer*. He translated Molière's *Tartuffe* and *School of Women*.

CHMIELNICKI, kmyél-nêts'kê, **Bogdan**, Cossack chief: b. 1593; d. Aug. 25, 1657. He was the son of a Polish nobleman, who settled among the Cossacks of the Ukraine. This people, who had long defended the eastern boundaries of Poland against the Tatars and Russians, were at that time subjected to grievous oppression. Their religion was persecuted, their freedom circumscribed and the castle of Kudak, called the curb of the Cossacks, was built to restrain them. Thus exasperated, they seized Kudak and massacred the garrison, but were soon subdued. After their defeat at Kumejki, Bogdan was sent to the Polish court, where he was favorably received, but suspicion soon drove him forth and finally made him a scourge of Poland. Availing himself of the hatred and prejudices of the Cossacks, he entered upon a conspiracy against the Poles, and sought the alliance of the khan of the Tatars. Chmielnicki became master of the Ukraine and carried terror, devastation, and death as far as Lemberg and Zamosc. Under the new king, John Casimir, the war was continued with equal ferocity on both sides until Chmielnicki was checked in 1651. He sought the protection of Turkey, of Russia (1654), and again that of Poland (1656), and finally lived in retirement under the suzerainty of the Czar of Russia. An equestrian statue commemorating Chmielnicki was erected at Kiev in 1873.

CHMIELOWSKI, kmyê-lôf'skê, **Piotr**, Polish writer: b. Podolia, 1848; d. Lwow, April 22, 1904. He was educated at the universities of Warsaw and Leipzig. Lecturing at the University of Warsaw on the history of Polish literature in 1880, he gave up the course when asked to speak in Russian rather than in Polish. He then devoted himself to editing the monthly literary review, *Ateneum*, which he published from 1881 to 1897, and to other literary endeavors. He did much to promote the culture of Poland. His works include *Goethe* (1878); *Rousseau* (1878); *Liberalizm i obskurantyzm* (1882); *Autorkipolski* (1885); *Adam Mickiewicz*, 2 vols. (1886); *Józef Ignacy Krasiński* (1886); *Studia i szkice* (1886); *Nasza Literatura Dramatyczna*, 2 vols. (1898).

CHOATE, chôt, **Joseph Hodges**, American lawyer and diplomat: b. Salem, Mass., Jan. 24,

1832; d. New York City, May 14, 1917. He was graduated from Harvard University in 1852 and from the Harvard Law School two years later. After practicing law in Boston for a year he went to New York City, where he achieved remarkable success as a lawyer. In 1856 he became active as a Republican in support of John C. Frémont. In 1884 he became a member of the famous legal firm of Evarts, Choate and Southmayd. He won great distinction as a trial lawyer, conducting many celebrated cases in state and federal courts, and international tribunals. He successfully defended Gen. Fitz-John Porter, prosecuted the infamous Tweed Ring, appeared in the Samuel J. Tilden will contest, the Chinese exclusion cases, and the income tax cases of 1894. In 1894 he was president of the New York Constitutional Convention. In 1897 he was a candidate for the United States Senate, but was defeated by Thomas C. Platt. President McKinley appointed him in 1899 to succeed John Hay as ambassador to the Court of Saint James', in which capacity he served with distinction till 1905. He was elected Benchman of the Middle Temple of London on April 10, 1905. In 1907 he served as ambassador and leading delegate of the United States to the International Peace Conference at The Hague, and his activity as a public-spirited citizen was manifested as a trustee of the Metropolitan Museum of Art and of the American Museum of Natural History, a governor of the New York Hospital (1877-1917) and in many other ways. His works include *Abraham Lincoln, and Other Addresses in England* (1910); *American Addresses* (1911); *The Two Hague Conferences* (1913).

Consult Strong, T. G., *Joseph H. Choate: New Englander, New Yorker, Lawyer, Ambassador* (New York 1917); Martin, E. S., *Life of Joseph H. Choate*, 2 vols. (New York 1920).

CHOATE, Rufus, American lawyer: b. Essex, Mass., Oct. 1, 1799; d. Halifax, N. S., July 13, 1859. As a child he showed remarkable precocity; was graduated from Dartmouth College in 1819; was admitted to the bar and began practice in Danvers in 1822; removed to Salem in 1828; and was a member of Congress in 1831-1833, resigning in the latter year. Moving to Boston in 1834, he rapidly acquired a large practice. He was successor of Daniel Webster in the United States Senate in 1841-1845; he resumed his legal practice in Boston at the expiration of his senatorial term. He traveled in Europe in 1850 and was a delegate to the Whig National Convention in Baltimore in 1852. After Webster's death Mr. Choate was acknowledged the leader of the Massachusetts bar. He made many political speeches, the most brilliant, while a United States senator, including those on the Oregon Boundary, the Tariff, the Fiscal Bank Bill, the Smithsonian Institution, and the Annexation of Texas. His style is peculiar and characteristic, but hardly to be commended as a model for imitation; it is rich, vivid, and glowing, instinct with passion and colored with all the hues of fancy, but sometimes, it must be admitted, a little extravagant and exaggerated. The most remarkable feature, however, in his written compositions, is the structure of his periods. These are not the short and compact statements, involving but a single proposition, in which modern writers of our times express their thoughts; they recall and renew the continuous sweep and long-resounding march of the prose writers of the

16th century. They are often of breathless length, containing clause after clause, modifying, enlarging, or limiting the leading idea.

Consult Brown, Samuel G., *The Works of Rufus Chabote, with a Memoir of His Life*, 2 vols. (Boston 1862); Fuess, Claude M., *Rufus Choate, the Wizard of the Law* (New York 1928).

CHOCANO, chò-kä'nò, José Santos, Peruvian poet: b. May 14, 1875; d. Santiago de Chile, Dec. 13, 1934. His early years are obscure. He was an active journalist, diplomat, and revolutionary politician, and spent some years in Colombia, Spain, Mexico, and Guatemala. He was an adviser to both Francisco Villa and Manuel Estreba Cabrera. Not long after he had returned to Peru in 1921, he killed one of his political enemies. Thereafter he lived in exile in Chile, where he was himself murdered. His poetry speaks out of both Indian and Spanish traditions, and defends Latin America against what he viewed as imperialism from the north. Although it sometimes fails to rise above rhetoric, it is generally rich, vigorous, and musical. The best-known of his volumes, *Alma América* (1906) influenced Rubén Darío in the development of American themes. His other works include *Iras santas* (1894), *Fiat Lux!* (1908), and *Primitias de oro de Indias* (1934).

CHOCOLATE and COCOA. See CACAO.

CHOCOLATE SOLDIER, The, an opera by Oskar Straus (1870-1954), first performed in Vienna in 1908 as *Der Tappere Soldat*. The work was first performed in the United States at New York City on Sept. 13, 1909. Among light musical productions of that era it is unusual for its freedom from sentimentalness. It is based on George Bernard Shaw's play *Arms and the Man*, and supports its story with music that is buoyant and melodious. Its best-known song is *My Hero*.

CHOCTAW, an American Indian tribe of Muskogean stock, closely related to the Chickasaw. The Choctaws' original homeland during historic times was central and southern Mississippi and southwestern Alabama. They were an agricultural people, raising corn, beans, and pumpkins for food and export to other tribes; and the most commercial minded of all the southern Indians. Apparently they were less interested in ceremonials than their neighbors, as noted for their songs and dances, which were more recreational than religious. They were a peaceable people, but fought bravely in defense of their homeland.

The tribe had three (possibly, in early times, four) geographical divisions, with somewhat different customs and dialects. Each had its head chief and council; and councils of the whole nation were called by the three chiefs acting in concert. Local government was managed by town officials and councils, though in historic times the "town" was a scattered agricultural settlement. The whole nation was divided into two phratries, within which marriage was prohibited. These were subdivided into clans, which were of fundamental significance in the social organization. Descent was from the female line. The Choctaws had a tradition that they and the Chickasaws had migrated as one people from a distant western land, and had become separated during the journey. They also had a

conflicting creation myth that they had originated at a great fortified mound on their northern frontier in Mississippi. They were first seen by Europeans when Hernando de Soto crossed their country in 1540.

From about 1700 the French in Louisiana, the Spanish in Florida, and the English along the Atlantic carried on complicated intrigues for their friendship and trade. In general they favored the French, though in the 1740's the tribe was torn by civil war between French and English adherents. In the Revolutionary War Choctaws served as scouts in the American Army; and in 1786 by the Treaty of Hopewell they recognized the sovereignty of the United States. Their warriors joined the Americans against the British and hostile Creeks in the War of 1812.

During this period the Choctaws learned to plant European fruits and garden vegetables; to raise livestock and barnyard fowls; and to grow, spin, and weave cotton for their clothing. At the same time several white men of ability and character settled among them and married Choctaw women; and their sons became leaders of progress within the tribe. In 1818 in response to an urgent appeal from the Choctaws, Christian missionaries began religious and educational work in their country. Then the tribe began to enact laws by rudimentary constitutional processes and reduce them to writing. Some of their leaders acquired Negro slaves and operated plantations.

But the white frontier advanced upon them; and in a series of treaties from 1801 to 1830 they surrendered their homeland and agreed to remove to a wild land comprising the southern half of Oklahoma. A census made just before they started showed a population of 19,554, including 97 intermarried whites and 248 Negro slaves. Of these, about 1,500 remained in Mississippi under a clause of the removal treaty by which they could select allotments of land and become United States citizens; but this provision was not fulfilled, and they sank into poverty. The main emigration took place during 1831-1833. An appalling number died; in 1843 a careful estimate set their population at 12,690. After that, it remained stationary; a census taken in 1885 listed 12,816 Indians, but the number of intermarried whites had increased to 427.

The Choctaws made remarkable progress in the new land. They established a constitutional government. They maintained a comprehensive school system. Their settlements were dotted with Presbyterian, Methodist, and Baptist churches, usually served by native pastors, often college trained. They laid out fields, planted orchards, accumulated live stock. The land belonged to the tribe, but each citizen was protected in the use of all he cared to cultivate. In 1837 the Chickasaws purchased the right to join them, but became dissatisfied, and under a treaty made in 1855 set up an independent government over their own district, which lay west of the Choctaw. The two tribes continued to own the land jointly; hence from this time on they negotiated all treaties together.

In the Civil War the Choctaws and Chickasaws joined the South. Their men served in the Confederate Army and they sent a delegate to the Confederate Congress. After the war when they resumed treaty relations with the United States, they were required to surrender an unsettled tract of land west of the Chickasaw district. They were given the option of adopting

their freedmen and receiving \$300,000 for the ceded land, or letting the United States remove the Negroes and expend the money for them. Both tribes requested the removal, but the government failed to act. Finally in 1885 the Choctaws gave their freedmen limited citizenship and property rights; and received their portion of the \$300,000.

In the westward movement following the Civil War the white frontier again reached the Choctaws. The first railroad was built across their country in 1872; and white city builders flocked to the stations. Extensive coal mines were leased to white operators and worked by white laborers. All this was regulated by the tribal government, which collected a royalty on the coal, a tax on the business, and a permit fee for the laborers; but many intruders filtered in illegally. The first federal census—made in 1890—showed a white population outnumbering the Choctaw almost three to one.

The United States then determined to abolish the tribal regime. The land was divided up into individual allotments, the tribal government was dissolved, and the Indians were given United States citizenship. When Oklahoma became a state in 1907, the Choctaws became a part of the general population. Their number is unknown. The allotment roll, totaling 26,828, is carried in Bureau of Indian Affairs statistics, but this roll, besides including 1,651 white and 6,029 Negro allottees, is the sum of those living on Sept. 25, 1902, the children born after that date and living on March 4, 1905, and the infants born after the second enumeration and living on March 4, 1906. At the time of allotment, 1,660 Choctaws were brought from Mississippi to share in the division of property; but many of them returned. In 1944 the number in Mississippi was 2,232—living near Philadelphia, in Neshoba County. In Oklahoma the Choctaws are distributed throughout the state—many are among its leading citizens—but fullblood settlements still exist in the southeastern portion. See also CHICKASAW.

ANGIE DEBO,

Author of "The Rise and Fall of the Choctaw Republic" and "And Still the Waters Run."

CHODAT, shō-dä', Robert Hippolyte, Swiss botanist: b. Moutier-Grandval, Bern canton, April 6, 1865. In 1890 he became a professor of botany at the University of Geneva, and was dean of the Faculty of Sciences there from 1898 to 1906, and rector of the university from 1908 to 1910. Besides numerous professional papers in botanical journals, he published important monographs.

CHODKIEWICZ, kôt-kyě'vèch, Jan Karol, Polish general: b. Lithuania, 1560; d. Khotin, Oct. 24, 1621. He served in the Spanish army under the duke of Alva and also under Maurice of Nassau. In 1596 he distinguished himself in the campaign against the Cossacks and in 1600 in the expedition of Jan Zamojski against the Turks. In 1602 he went to Livonia as commander of the Polish army, and three years later he inflicted a crushing defeat on Charles IX of Sweden at the Battle of Kirchholm. He made an unsuccessful campaign against Russia, and before his death won a decisive victory over the Turks at Khotin.

CHODOWIECKI, kô-dô-vyěts'kê, Daniel Nikolaus, German painter and engraver: b. Dan-

zig, Poland, Oct. 16, 1726; d. Berlin, Feb. 7, 1801. He worked first in business in Danzig and, after 1743, in Berlin. In 1754 he turned to painting. He painted snuff boxes, worked at enamel-painting, and did miniatures. The Academy of Art of Berlin commissioned him to make designs for its almanac; the result, a set of miniatures depicting the life of Jesus Christ, established his reputation. Thenceforth he worked chiefly as an engraver. After 1757 he executed more than 2,000 engravings, the vast majority of which appeared as book illustrations. Besides illustrating first editions of works by Gotthold Ephraim Lessing, Johann Wolfgang von Goethe, Johann Christoph Friedrich von Schiller, and Friedrich Gottlieb Klopstock, he did illustrations for *Don Quixote*, the works of Shakespeare and Voltaire, Oliver Goldsmith's *The Vicar of Wakefield*, and many other works. In design and execution he was a master craftsman. His painting depicting Jean Calas and his family is well-known. He became director of the Academy of Arts in 1797.

CHODZKO, kôj'kô, Aleksander, Polish Russian writer and scholar: b. Krivichi (Krywicze), Russia, July 11, 1804?; d. France, Dec. 20, 1891. He served for a while as a Russian consul in Persia. From 1858 to 1894 he was professor of Slavic languages and literature at the Collège de France in Paris. His works include *Le Théâtre en Perse* (1845), *Grammaire persane* (1852), *Légendes slaves du moyen-âge* (1859) and *Grammaire paléoslave* (1869).

CHODZKO, Leonard Jakób, Polish scholar b. Oborek, Lithuania, Nov. 6, 1800; d. Poitiers Department of Vienne, France, March 12, 1871. Having traveled as secretary of Michał Kleofa Ogiński through nearly all of Europe, he established himself in 1826 at Paris, where he published a memoir of Ogiński, with an introduction entitled "Observations sur la Pologne et les polonais" (1827). He later published *Histoire des légions polonaises en Italie* (1829). During the revolution of July 1830, he served as adjutant to the marquis de Lafayette; and after the outbreak of November 29 of the same year in Warsaw, he acted as agent of the revolutionary government in France. The most important of his writings was *La Pologne historique, littéraire, monumentale et pittoresque*, 3 vols. (1835-1837).

CHOENIX, kê'nîks, a dry measure of capacity among the ancient Greeks. It was used particularly for grain, and is said to have been the normal daily ration of a man. Its size differed at various times and in various parts of the Greek world. Some accounts represent it as containing three cotulae, or about 1.487 pints English; others make it equal to 1.982 pints; and still others give it as equal to 3.964 pints. Scholars now generally suppose it to have been equal to about 1 quart in the Anglo-American scale of dry measure.

CHOERILUS, kêr'i-lüs, the name of several Greek poets. **CHOERILUS OF ATHENS** (fl. 6th-5th cent. B.C.) was a tragic poet. According to Suidas, he began writing plays in 523 B.C. and competed as a playwright with Aeschylus and Pratinas. He is said to have effected changes in the tragic mask and costume. Of his tragedies none survives and the name of only one, the *Alope*, is known. **CHOERILUS OF SAMOS** (fl. late 5th cent. B.C.) composed an epic poem, *Perseis*, celebrating

victory of the Greeks over Xerxes I. He was a friend of Herodotus, and, according to Suidas fled Samos after him. Later, he celebrated the feats of Lysander. He died at the court of Archelaus of Macedonia. *Perseis* is notable for its celebration of an historical rather than a mythological subject. The fragments still extant were collected and explained by A. F. Näke (1817). CHOERILUS OF IASOS (fl. 4th cent. B.C.) was also an epic poet. He was among those who accompanied Alexander the Great on his expedition to the East. Horace mentions him in his *Epistles* as an example of an extremely bad poet.

CHOIR. *In religious worship*, an organized body of singers. In ceremonial Christian religions, the choir officials and choristers, or other singers taken collectively, are spoken of as the choir. Typical choral organizations in cathedrals and churches of the Church of England are usually divided into two sets of voices, the one sitting on the north and the other on the south side of the chancel, and are known by the respective titles of cantoris and decani from their nearness to the cantor, or precentor, and to the decanus, or dean. In most cathedrals and collegiate churches, the decani side is held to be the side of honor, the best voices are placed there, and all the verses or solo parts, if not otherwise directed, are sung by that side, which is also considered the "first choir" (*coro primo*) in eight-part music. In Roman Catholic churches the choir is customarily assigned to a gallery at the opposite end of the church from the main altar, or to a similarly conspicuous place.

In architecture, that part of a church designed for the stalls of the clergy and choir. A bench for the clergy, with the bishop's throne in the center, surrounded the semicircular apse of early Christian basilicas. The nave allotted to the laity was much larger than the space reserved for the clergy, but as the latter including the choristers grew in numbers, the apse could not accommodate them. Therefore, in certain later basilicas, such as San Clemente, Rome, the clergy overflowed into the nave and were screened from the congregation by a low wall. With the growth of monasticism in the later middle ages, more definite removal of the monks or canons from the laity became desirable. Indeed many offices were celebrated for the clergy alone, and the laity had their own separate services in the nave. Hence, an additional unit, the choir, was inserted in front of the sanctuary and was often separated from the laity by a choir screen. Where this was inadequate, the choir might encroach on the nave and the choir screen be located there, as for example, in Westminster Abbey, London. This is confusing; the *architectural choir* lies between the sanctuary or chancel and the crossing, while the *ritual choir* is the space assigned to the choir stalls. Hence the ritual choir may include not only the architectural choir but the crossing and part of the nave. Further confusion results from applying the term, choir loosely to refer to the entire eastern end of the church.

The width of the choir is determined by the number of rows of choir stalls required, and its length by the number of stalls in each row. If two rows of stalls on either side flanked the central aisle, about 28 feet sufficed; three such rows occupied about 42 feet. The architectural choir tended to determine the width of the chancel and north

of the church. Hence in churches served by monks or canons—and most of the greater churches particularly in England were of this class—the choir determined the church. Generally during the middle ages the sanctuary and choir were built first, followed by the nave. In the Cathedral of St. John the Divine, New York City, the first service in the choir and crossing was held in 1911; the first in the completed nave in 1941. However, as the fortunes of a diocese improved, it often replaced its venerable sanctuary and choir but not its nave. Thus at Beauvais, France, the nave, called the *basse oeuvre*, is centuries older than the Gothic apse, choir, and transepts; at Gloucester and Ely, England, 12th century naves lead up to 13th or 14th century choirs.

EVERARD M. UPJOHN,
Professor of Fine Arts, Columbia University.

CHOIR INVISIBLE, The, a novel by James Lane Allen, first published as *John Gray* in 1893, and enlarged and republished under its present title in 1897. Its scene is late 18th century Kentucky, and the descriptions of pioneer life give it historical value.

CHOISEUL, shwá'zúl', Duc César de French soldier: b. Paris, Feb. 12, 1598; d. there Dec. 23, 1675. He participated in the siege of La Rochelle, made a successful defense of the Île d'Oléron against the English, and beat them back at the Île de Ré. From 1630 to 1635 he was French ambassador at the court of Savoy. He later played a distinguished part in the Italian and Spanish campaigns. In the first outbreak of the Fronde he led in besieging Paris (1649); in the second outbreak he won over the Vicomte de Turenne and the Spanish at Rethel (1650). He became a marshal of France in 1645, minister of state in 1652, and a duke in 1665. During much of his life he was known as the Sieur du Plessis-Graslin.

CHOISEUL, Duc Étienne François

(early life COMTE DE STAINVILLE), French statesman: b. June 28, 1719; d. Paris, May 8, 1785. Entering the army in early life, he distinguished himself in the War of the Austrian Succession and served afterwards in the Low Countries, 1748. His marriage in 1750 with a member of the Crozat family gave him the command of great wealth, and his intimacy with Mme. de Pompadour furnished the means of gratifying his ambition; as he gratified hers by the expulsion of the Jesuits, whom he had come to regard as much as she did. As ambassador to Russia from 1754 to 1757 he obtained from Pope Benedict XIV the celebrated encyclical letter intended to appease the disputes which had arisen on the bull Unigenitus. While ambassador to Austria in 1757–1758, he concluded with Marie Thérèse a treaty of alliance against Prussia. He became minister of foreign affairs and was made a duke in 1758, and from 1761 to 1766 he served as minister of war and minister of the navy. His administration was marked by many reforms. He organized and revitalized the army and negotiated the Family Compact, reuniting various members of the Bourbon family; restored Lorraine and Corsica to France; pursued a hostile policy toward England and his failure to provide for adequate defense of the North American colonies led, in the Paris Peace Treaty (1763), to results unfortunate for France.

controlled French policy until 1770, when his fall was brought about by Mme. du Barry, the king's new favorite. The total suppression of the Jesuits by Pope Clement XIV came after his fall, but it was partly due to negotiations which he had initiated on behalf of the Bourbon kings. He was recalled to court on the accession of Louis XVI in 1774, but was not again entrusted with power.

CHOISEUL, shwá'zúl', island, Solomon Islands, southwest Pacific. One of the three main northern islands of the Solomon archipelago, it is located about midway between Bougainville and Santa Isabel islands. It is 90 miles long and, at its broadest point, 20 miles wide. The island is volcanic, and reaches an elevation of 2,470 feet. The inhabitants produce copra. Choiseul was controlled by Germany from 1886 to 1899, when it passed to the British. The Japanese occupied it in 1942-1943.

CHOISEUL-GOUFFIER, gōō-fě'ā, COMTE de (full name MARIE GABRIEL FLORENT AUGUSTE de CHOISEUL-GOUFFIER), French antiquarian and diplomat: b. Paris, Sept. 27, 1752; d. Aachen, Germany, June 20, 1817. He visited Greece in 1776. The result was his principal work, *Voyage pittoresque de la Grèce* (1780-1824). He was elected to the Académie Française in 1783. From 1784 to 1791 he was French ambassador at Constantinople. After his return to France in 1802, he was named minister of state. His valuable collection of antiquities is now in the Louvre museum.

CHOISEUL-PRASLIN, prā-lān, COMTE de (full name EUGÈNE ANTOINE HORACE CHOISEUL-PRASLIN), French statesman: b. Paris, Feb. 23, 1837; d. there, Dec. 6, 1915. In 1869 he was elected to the Corps Législatif and in 1871 to the National Assembly. He was minister plenipotentiary to Italy in 1871. In 1880 he became secretary of state in the ministry of foreign affairs, under the premiership of Jules François Camille Ferry. He was regarded as very influential in the Republican majority.

CHOISY, shwá'zé', François Auguste, French civil engineer and historian of architecture: b. Vitry-le-François, Department of Marne, 1841; d. 1909. He was chief civil engineer and professor of architecture at L'École des Ponts et Chaussées in Paris. His most notable book is *Histoire de l'architecture* (1899), an exhaustive treatment of the evolution of structural and decorative forms. Among his other works are *L'art de bâtir chez les Romains* (1873); and *L'art de bâtir chez les Égyptiens* (1904).

CHOISY, ABBÉ François Timoleon de, French ecclesiastic and author: b. Paris, Aug. 16, 1644; d. there, Oct. 2, 1724. He was the son of the secretary to Gaston Jean Baptiste d'Orleans, brother to Louis XIII, and among members of the court early acquired notoriety for his wearing of feminine dress and his taste for intrigue. In 1683, following a serious illness, he turned to religion, and in 1685 he went on a mission to Siam. He became a priest in 1686. His many writings include both *Histoire de madame la comtesse des Barres* (1735), an account of the life he experienced in feminine guise, and serious works such as *Histoire de l'Église depuis la naissance*

du Christianisme jusqu'à la fin du règne de Louis XIV (1703-1723). The work for which he is remembered, however, is his undated *Mémoires*, which, though often inexact in historical detail, contains invaluable portraits of contemporaries.

CHOISY-LE-ROI, shwá'zé'lě-rwā', commune, department of Seine, France. It is located seven miles south of Paris, on the left bank of the Seine. Anne Marie Louise d'Orleans, Duchesse de Montpensier, built a pleasure chateau here in 1682 which was later acquired by Louis XV as a residence. It was destroyed during the revolution, but ruins remain. Claude Joseph Rouget de Lisle, composer of the *Marseillaise*, is buried in the town cemetery. Choisy-le-Roi was the site of a battle between the French and the Prussians on Nov. 30, 1870. There is varied manufacturing. Pop. (1946) 27,333.

CHOISYA, a small genus of four or five species of shrubs in southern North America belonging to the rue family (Rutaceae). One species, *Choisya ternata*, the Mexican orange, is cultivated in the warmer parts of the United States and sometimes in greenhouses for its fragrant, orange-like flowers.

CHOKEBERRY, the name given to *Aronia*, a small shrub of eastern North America. It is indigenous to swamps, but is cultivated as an ornamental shrub. The leaves are serrate and glossy; the flowers, generally white. The red chokeberry, *Aronia arbutifolia*, is an erect shrub growing as high as 10 feet. The purple chokeberry, *Aronia prunifolia*, closely resembles it. The black chokeberry, *Aronia melanocarpa*, is a low shrub of 4 feet or under, and differs also from the other two in having leaves which are smooth beneath.

CHOKECHERRY, the common name of *Prunus virginiana*, a large shrub or small tree native to North America. It is found most often on river banks or in rocky situations, and is thicket-forming. Its white flowers form fruits which deepen in color as they mature from red to purplish-black. The western chokecherry, *Prunus demissa*, is similar. The closely related black or rum-cherry, *Prunus serotina*, is valuable for its wood. Its aromatic bark distinguishes it from the chokecherry.

CHOKEDAMP or **BLACKDAMP**, a gas found mainly in old or unventilated mines. It is heavier than air, and consists chiefly of carbon dioxide, though it also contains a small, variable proportion of nitrogen. It supports neither life nor flame. With a drop in atmospheric pressure the gas may emerge into mines being worked. A product of natural oxidation, it is found also in caves and wells.

CHOKING, a stoppage caused by the passage of fumes, a gas, or a solid substance into the larynx or upper opening of the trachea, or by an obstruction of the esophagus itself. It is usually followed by a violent fit of coughing which lasts, in slight cases, until the offending substance is expelled. Sometimes, however, a larger mass of solid substance is drawn into the opening of the trachea, completely blocking it, and arresting respiration altogether. This condition is one of ex-

tre danger; the sufferer becomes purple in the face, and if not at once relieved will die of suffocation. The obstructing substance may often be dislodged by means of the fingers. A child may sometimes be saved by holding it up by the heels and shaking it, or slapping its back. If these measures fail, an emergency surgical opening of the trachea may be effected in order to admit air below the obstruction and thus prevent death. In the case of an animal, the obstruction may often be removed by means of the hand, or, through the administration of water, oil, or belladonna solution, the animal may be forced to swallow the obstructing substance. Sometimes the substance may be pushed down by means of a probang. In some cases it is necessary to resort to surgery.

CHOLA, chō'lā, an ancient Tamil kingdom, southern India. Located in what is now the state of Madras, it comprised the area extending north from Pudokkotai to Nellore. It existed from the 4th century B.C. During the period 907-1310 A.D. it held supremacy in southern India. It ruled over Ceylon in the first half of the 11th century. A Moslem invasion destroyed the kingdom. Tanjore, which was its principal capital, still contains the kingdom's chief architectural monument, an 11th-century temple.

CHOLECYSTOGRAPHY, kōl-ê-sis-tōg'-rā-fi, a method of depicting a test of the concentrating ability of the gall bladder. A dye (tetraiodophenolphthalein) is administered, usually by mouth and on an empty stomach. After several hours X-ray films are made of the gall bladder, first in the absence of any food in the digestive tract and later following the taking of a certain quantity of fat such as cream. The interpretation rests on the determination of the amount of variation from the normal density of the gall bladder shadow. Data concerning the degree of remaining function are said to be reliable in more than 95 per cent of cases. In many cases stones will be visualized in plain films but not always, even in gall bladders which contain a large number.

HAROLD W. JONES, M.D.

CHOLERA, kōl'ēr-ā, (**CHOLERA ASIATICA**; **CHOLERA INDICA**), an acute, specific, infectious, and contagious disease affecting especially the terminal ileum of the small intestine. It is caused by the *Vibrio cholerae*, the so-called comma bacillus. The causal organism is a small, curved, motile, gram-negative bacillus having a flagellum at one end. The disease is confined entirely to man and the bacillus finds its way into the body through the mouth, by way of contaminated food or drink. The greatest single source of infection is a contaminated water supply, as exemplified especially, by serious epidemics occurring in cities near the river Ganges in India throughout many centuries and, in the latter part of the 19th century, in Hamburg, Germany. The organism can persist in water for as long as 7 days. Other sources are through insect carriers, such as roaches and flies, which convey the bacilli from human feces to food.

History.—Cholera has a long history and is said to have originated in the Far East, perhaps thousands of years ago. Sanskrit writings indicate that it existed many centuries before the Christian era. It was first described

adequately, however, in comparatively modern times in the year 1563, by Garcia del Huerto (1490-1570), a Portuguese physician at Goa, India. The mode of communication by infected water was first demonstrated in 1849 by John Snow (1813-1858), a well known physician of London. Robert Koch of Berlin (1843-1910) discovered the bacillus of cholera in 1884. Serious epidemics of the disease occurred in the 17th and 18th centuries but these were confined to Asiatic countries. The great pandemics of 1826 to 1837 resulted in cholera's spreading to Europe for the first time. Eventually it reached Marseilles, from the Eastern countries, and from there it spread to Paris. In the United States it was first observed about 1832 and was in epidemic form in 1835, 1836, 1849, 1854, 1867, 1873, and 1884. The last epidemic was in 1893 but it had not assumed serious proportions since 1873, when it ceased to be a menace. In the Philippine Islands it has existed in sporadic form during the present century. The last epidemic of any size was in 1911.

Etiology.—True Asiatic cholera is caused only by the *Vibrio* and no disease of other origin, no matter what the symptoms, may be called cholera. Thus cholera infantum, once applied indiscriminately to acute diarrhea in infants, is misnamed, as it is actually caused by the invasion by bacilli of dysentery. The same is true of acute enteritis in adults, sometimes referred to as cholera morbus. (See **DYSENTERY**.) The disease hog cholera is caused by *Salmonella cholerae* and, although the name has persisted, this is not a true cholera which never exists in animals.

Symptomatology.—The incubation stage varies from a few hours to about 5 days, the average being 3 days. The onset of cholera is abrupt, with terrific purging, so that there is practically no control over the action of the bowels. This makes the disease the more dangerous since the dejecta of a cholera patient, unless disposed of promptly, are effective in spreading the disease. Within a few hours vomiting is apt to ensue, accompanied by violent muscular cramps and great prostration. The stools at first contain fecal matter which is soon changed to the characteristic "rice water" evacuations containing only flakes of mucus. In severe forms of the disease there is suppression of urine and extreme dehydration. The body shrinks to a fantastic degree, the skin is dry and wrinkled, as are all mucous membranes. The face becomes pinched, the eyes are sunken, the limbs cold and cyanotic, with all the appearances of impending death. The patient is restless but realizes his condition, for his mind is usually clear. In this, the so-called algid stage, the body temperature may fall to 75°F. The amount of water lost by the body may be from 8 to 10 quarts in 24 hours. Blood examination may show the red cells increased to 8,000,000 from a normal of 5,000,000, while the white cell count may be as high as 60,000 per cubic centimeter. Most of the deaths occur in the first 24 hours but, if the patient survives the algid stage, the stage of reaction develops. Here the blood pressure rises to normal, color returns to the skin, the stools become less frequent, the temperature may be about normal, while the general state exhibits improvement. Nevertheless the outlook for

recovery is still uncertain for suppression of urine may develop or may persist if present and despite all efforts the sufferer, who seems on the brink of recovery, may die of uremia. Where death occurs, relatively few changes are to be found at the seat of the disease, beyond small erosions and minute hemorrhagic points in the terminal ileum.

Diagnosis.—This is made usually on the pathognomic symptoms and signs as given, aided by the known incidence of the disease in the area in which the patient is seen. It is confirmed by finding the *Vibrio* in the stools through culture methods and smears. As will be appreciated, to wait for a bacteriological confirmation in the presence of a cholera epidemic before beginning appropriate treatment will often result in the loss of the patient. Specific agglutination of the organisms in cholera-immune serum in 1:1000 dilution is also of assistance in confirming a diagnosis. The only diseases apt to be confounded with cholera are, food poisoning, bacillary dysentery, heat prostration in tropical countries (where bowel symptoms are present), and certain forms of poisoning by arsenic, mercury, mushrooms (poisonous varieties), and methyl alcohol.

Treatment.—This may be divided into general preventive measures for the community (public health practice), prophylaxis for the protection of individuals, and curative, applied to the patient who is actually seized with the disease. Cholera could be eliminated largely from the world if water supplies could be protected from pollution and if water already polluted could be barred effectively as a source of supply for drinking. In a country like India, for example, with its overpopulation under conditions of unsatisfactory sanitation, combined with extreme poverty, ignorance, and blind adherence to tradition, the total prevention of cholera is a practical impossibility, since religious pilgrimages cannot be prevented or even controlled. Neither can carriers be detected always nor the river Ganges be placed off limits, as a source of drinking water. In countries having a modern public health service there is little danger of cholera's obtaining a foothold and still less of its assuming epidemic proportions. In Oriental countries, however, there is an everpresent danger of the disease getting out of hand. In general, prophylactic measures will consist in preventing pollution of water supplies, in keeping streets clean, in prompt disposal of garbage, sewage and human wastes, with disinfection or burial as indicated, in control of the sale of raw vegetables and fruits, and in strict quarantine. This last will include isolation of all patients suspected of having cholera, and a 5 day detention period in quarantine of those who have been exposed to the disease. During an epidemic it is usually insisted that food, drinking water, and milk must be sterilized and that raw vegetables and fruits be cooked or scalded before eating. Immunity for several months may be obtained by the subcutaneous injection of 4 to 8 billion attenuated *Vibrios* (Haffkine's vaccine) at intervals of 10 days. In the presence of the actual disease, curative and life saving measures must be prompt to be availing. The most important thing is to recognize the disease at once and to give large amounts of normal or hypertonic salt solution intravenously. Here it should be

emphasized that large amounts means quarts and gallons, not pints. A delay of even an hour or two in instituting this treatment has lost many lives. During an epidemic, if cases can be detected promptly, if they can be given bed rest, can be kept warm, and if salt solution can be administered when and where they are first seen, mortality can be greatly reduced. Patients die early, not so much from toxemia as from extreme dehydration, since the circulatory system cannot function properly, much less combat the toxic effects, unless the fluid lost from the discharges can be made up at once by intravenous injections. Drugs are of little value but from time to time, small doses of morphine may alleviate the pain of the muscle cramps. Mortality in cholera varies with the epidemic and may be as high as 50 per cent. Under modern methods of treatment and organization this would probably be lower, should an epidemic occur.

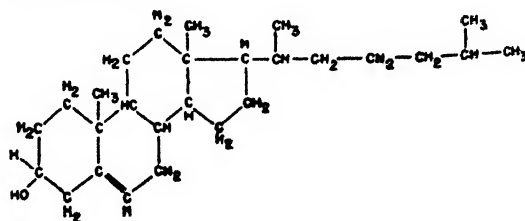
Bibliography.—Snow, John, *On the Mode of Communication of Cholera* (London 1849); Koch, Robert, "The Cholera Bacillus," in *Deutsche Medicinische Wochenschrift*, vol. 10, pp. 725-728 (Berlin 1884); Pierson, George M., and Bortz, Edward L., *Cyclopedia of Medicine, Surgery and Specialties* (Philadelphia 1949).

HAROLD W. JONES, M.D.

CHOLERA INFANTUM, an old term for acute bacillary dysentery in infants. See DYS-ENTERY.

CHOLESTEATOMA, kōl-ê-stê-à-tō'mā, (1) a tumor of the brain which may occur in the bones of the skull or within the brain substance or ventricles. It is a growth of small pearly nodules, usually springing from the cerebral meninges, formed of concentric layers of endothelial or epithelial cells, often surrounding a core of cholesterol crystals and fat globules. (2) A tumor of the middle ear resulting from nature's attempt to arrest suppuration in the tympanic cavity by epidermatization, the new skin-like membrane then degenerating.

CHOLESTEROL, kō-lēs'tēr-ōl (old name CHOLESTERIN; Gr. *cholē*, bile, and *stereos*, solid), an unsaturated secondary alcohol, formula $C_{27}H_{46}O$, found throughout all the tissues and fluids of animals, but more particularly in brain and nerves. It is abundant in egg yolk, milk, wool fat, and gallstones, the latter often being almost pure cholesterol. Although isolated from gallstones in pure form in 1823, the chemical structure proved so difficult to determine that when Heinrich Wieland and Adolf Windaus were awarded the Nobel Prize for 1927 and 1928 for determining its structure, later results soon proved them wrong. The correct formula is now known to be



The complex basic ring structure, known chemically as cyclopentanoperhydrophenanthrene, is the basis of classifying a number of biologically important compounds into a group called

the steroids. These substances include, besides cholesterol, such important compounds as the sex hormones, cortisone and similar hormones of the adrenal cortex, vitamin D, the bile acids, and the cardiac glycosides or glucosides (*digitalis*) as well as many plant sterols, saponins and toad poisons.

Cholesterol is readily synthesized in the animal body from simple molecules such as acetic acid and acetoacetic acid which the body also synthesizes, usually from fat. It can also, of course, come from the diet.

The functions of cholesterol in the animal body are very poorly understood. That it is needed, especially in nerve tissue, is almost self-evident from its invariable occurrence. There is much evidence that it can serve as precursor for other important steroids such as the bile acids, and the sex and adrenocortical hormones but other research work indicates that such a path is not obligatory and that the latter compounds can be synthesized either directly or from some unknown compound which is the precursor for all the steroids. It does serve as a precursor for vitamin D, the vitamin being formed by action of ultraviolet light on 7-dehydro cholesterol in the skin.

In many cases of hardening of the arteries there is marked deposition of cholesterol in the walls of the blood vessels. This effect is believed to be due to a breakdown of the mechanism for proper metabolism of cholesterol, rather than to an excess of this compound in the diet, but the condition may be somewhat alleviated by dietary changes which restrict cholesterol intake.

Consult Fieser, A. F., and Fieser, M. A. P., *Natural Products Related to Phenanthrene*, 3d ed. (New York 1949)

M. WIGHT TAYLOR,
Associate Professor of Agricultural Biochemistry,
Rutgers University.

CHOLET, shô-lě', commune, France, in the Department of Maine-et-Loire, on the right bank of the Maine River, 32 miles southwest of Angers. Its manufactures include handkerchiefs and cotton goods called *cholettes*, flannels, and woolen stuffs, as well as cartons, footwear, toys, and organic fertilizer. The town also trades in cattle, lumber, and grain. Granite is quarried nearby.

The first considerable growth of the town occurred in the 17th century when a colony of weavers settled there under Edouard Colbert, Comte de Maulévrier. Here during the Vendean War, two actions were fought in 1793, in both of which the Royalists were decisively defeated. Pop. (1946) 26,086.

CHOLIAMB, kô'li-ămb (Gr. *choliambos*, the lame iambus), an iambic trimeter, the last foot of which, instead of being an iambus, is a trochee or spondee, which gives it a lame motion. It is also called scazon (Greek *skazôn*, to halt) or versus Hipponacticus, because of the use that the satirist Hipponax of Ephesus made of it.

CHOLINE, kô'lên; kôl'ên, -în, a nitrogenous base ($C_5H_{12}NO_2$) found in both plants and animals. It is a compound of lecithin and other phospholids. Used as a drug it has an effect similar to that of parasympathetic stimulation. It is a vitamin of the B complex.

CHOLON, shô-lôn', city, Viet Nam, in

Cochinchina, 4 miles southwest of Saigon, on the left bank of the Donnai, an affluent of the Saigon River. It is connected with Saigon by a railroad as well as by roads and canals. It is the center of an important rice-producing area for which it is the market. Besides rice processing, its industries include distilling, soap, and tobacco processing. The rice industry was developed by the Chinese, representing about a third of the population, who are also responsible for the small boat-building industry and a greater part of the commercial river traffic.

Founded by Chinese immigrants from Bien-hoa in 1778, Cholon became a municipality in 1879 and gradually merged with Saigon to form a large urban area. Since 1932 Saigon and Cholon have been jointly administered.

During World War II Cholon was occupied by the Japanese and was the scene of much suffering in the subsequent Viet Nam Revolution. Pop. (1936) 145,254; (1949 est.) 100,000.

CHOLULA, chô-lôô'lă (in full **CHOLULA DE RIVADABIA**, thă-rê-vă-thă-vyă), town, Mexico, in the state of Puebla. It is 6 miles west of La Puebla, with which it is connected by rail, and 60 miles southeast of the city of Mexico, at an altitude of 7,000 feet. The streets are regular and spacious, the houses mostly of one story and flat-roofed. A rail junction, it produces cereals, maguey, fruit, vegetables, and livestock, and its industries include wine and liquor distilling, flour milling and textile manufacturing. Nearby is a pre-Columbian pyramid (175 feet high) of clay and brick, surmounted by a Christian church. The town is famous for its many churches occupying the sites where native temples used to stand.

Cholula was the chief city of a semi-independent state settled by a Toltec tribe. Before the coming of the Europeans, the inhabitants carried on a considerable trade and had a type of democratic government. It was visited by Cortes in 1519, and in spite of his friendly reception by the inhabitants, he massacred a portion of the population, suspecting a plot against the Spaniards. Pop. (1940) 8,424.

CHOMO LHARI, chô'mô hlă'rê, or **CHUMALHARI**, chôô-mă-, a mountain peak in the Himalayas on the undefined border between Bhutan and Tibet.

CHOMUTOV, kô'môô-tôf (German **KOMOTAU**, kô'mô-tou), city, Czechoslovakia, is located in northwest Bohemia in the foothills of the Erzgebirge, 52 miles northwest of Prague. Chiefly an industrial center, it is a rail junction and manufactures industrial pipes, wire cables, cutlery, turbines, and textiles. Its metallurgical works are employed in finishing metal products manufactured at Kladno. In the vicinity coal is mined, hops are grown, and dahlias extensively cultivated. Pop. (1947) 26,697.

CHONDROSTEI, kôn-drôs'tê-î, an order of ganoid fishes of lowly organization, such as the sturgeon, paddlefishes and their fossil predecessors. The internal skeleton is but little ossified, the vertebrae and most of the skull remaining in a stage of pure cartilage; but the skull is enclosed by close-fitting dermal bony plates. There are no true scales, but a small number of longitudinal rows of large bony plates,

with granules on the intervening skin. The elongated snout, stout body, large fins, and strongly heterocercal tail complete the aspect of these survivors of a once dominant race that flourished from the Lower Devonian through the Mesozoic, except the Cretaceous period; and from after the Eocene steadily diminished, until of seven great families only two remain, represented by a few species that exhibit degeneracy from the ancient type.

Consult Zittel, Karl Alfred von, *Grundzüge der Paläontologie* (Munich 1895); Woodward, Sir Arthur Smith, *Outlines of Vertebrate Paleontology* (Cambridge, Eng., 1898); Romer, Alfred Sherwood, *Vertebrate Paleontology*, 2d ed. (Chicago 1945).

CHONDRUS, kōn'drūs, in botany, a small genus of marine algae the best-known species being *C. crispus*, the carrageen (q.v.).

CHONE, chō'nā, city, Ecuador, located in the tropical lowlands of Manabí Province, 110 miles west-southwest of Quito. It has rich cacao, coffee, and sugar plantations; it also produces rice, balsa wood, and tagua nuts. It is noted as a manufacturing center for Panama hats. Pop. (1950) 8,030.

CHONGJU, chŭng-jōō, town, North Korea, in North Pyongan Province. It is an agricultural center and gold is mined nearby. Pop. (1944) 18,633.

CHONGJU, city, South Korea, located in North Chungchong Province, 70 miles south-southeast of Seoul. It is an agricultural and industrial center. Pop. (1949) 64,571.

CHONOS, chō'nōs, an Indian tribe, now almost extinct, who occupied the islands of the Chonos Archipelago, and the neighboring Chilean coast. Their huts resembled bark-topped wigwams. Some shell-middens and a few artifacts have been discovered on Chiloé Island, showing a primitive culture. Their language was thought to form a distinct stock but may have been an Alacalufan dialect.

CHONOS ARCHIPELAGO, islands, Chile, about a thousand in number, located in Chiloé Province, lying along the coast of Patagonia. The archipelago is separated from the mainland by Moraleda Channel. Most of the islands are semibarren and uninhabited except for a few Chonos Indians. Melinka, on Ascensión Island in the Guaitecas group, which is sometimes considered a part of Chonos Archipelago, and Puerto Lagunas, on Melchor Island, are the only settlements of any importance. The latter maintains a radio station.

CHOPIN, shō-pān', **Frédéric-François**, Polish-French composer and pianist; b. Żelazowa Wola (near Warsaw), Poland, probably Feb. 22, 1810; d. Paris, France, Oct. 17, 1849. The exact date of Chopin's birth cannot be established beyond doubt. His father, Nicolas (1771-1844), was a Frenchman who had become first a bookkeeper and then a teacher of French in Poland; his mother, Tekla Justina Krzyżanowska (1782-1861), was an upper-class Polish woman in reduced circumstances. Frédéric-François, one of four children, was an only son. He very early displayed an intense, emotional interest in music, and began eagerly to study the piano when

only six, joining his elder sister Ludwika (Louise) in taking lessons from Adalbert Zywny, a Czech who taught pupils from the small boarding school that their parents ran to supplement Nicolas' income as a lyceum teacher. In 1817 his first published composition was issued privately in Warsaw; it was a Polonaise in G Minor dedicated to Countess Victoire Skarbek, by whose family his parents had formerly been employed. The boy appeared at a Warsaw salon concert on his eighth birthday, playing a concerto by Adalbert Gyrowetz. Later in 1818 he was permitted to present the visiting Dowager Czarina Marie Feodorovna (1759-1828), with two polonaises of his own composition. In 1822 or 1823 he began to study composition with an able Silesian named Joseph Elsner, and in the latter year he entered the Lyceum in which his father taught, studying Greek, Latin, mathematics, natural history, and the Polish historical and literary past. He never became a really well-educated man, and his range of intellectual interests always remained narrow.

Chopin's Opus 1, a Rondo in C Minor, was published in Warsaw in 1825. The earliest published example of his music to maintain strictly musical interest is his Opus 2, Variations for Piano, with sketchy orchestral accompaniment, on *Là ci darem la mano* from Mozart's *Don Giovanni*, probably composed when Chopin was 17. During 1828 a family friend took the youth on a visit to Berlin, where he first heard opera performed on a professional scale, and where he first viewed the great world of Western Europe. In 1829 he gave two concerts in Vienna, both including his *Krakowiak*, a concert rondo for piano and orchestra. During 1829, too, he became infatuated with a young singer, Constantia Gladkowska, a fellow pupil at the Warsaw Conservatory of Music, in which he had enrolled three years earlier. His impact on the aristocratic Warsaw public as both pianist and composer was reinforced during 1830 when he played the solo parts in his two piano concertos (F Minor and E Minor). Later that year, nevertheless, he left Poland forever, going via Breslau (Wrocław), Dresden (where he probably initiated his lifelong friendship with Countess Delphine Potocka), Prague, Vienna, Munich, and Stuttgart, to Paris. He reached the French capital in September 1831 and in effect settled down there for the rest of his life. He seems never to have known that two sisters of his father were still living in eastern France, in the Vosges Department.

At 21, Chopin had already earned a considerable reputation in German and Austrian musical circles, but his period of greatest prominence and productivity began shortly after he settled in Paris. There he soon won the affectionate regard of aristocratic music lovers, and notably of titled women. He was at various times on friendly terms with such men as Vincenzo Bellini, Hector Berlioz, Eugène Delacroix, Théophile Gautier, Franz Liszt, and Giacomo Meyerbeer. In 1835, visiting Karlovy Vary (Karlovy Vary), he saw his parents for the last time. On that journey he also met Clara Wieck and Robert Schumann, and at Dresden fell in love with a Polish girl, Marie Wodzinska, to whom he proposed marriage the following year. In 1836, however, he began at Paris his enduringly famous relationship with George Sand (Baronne Dudevant).

Chopin's physical constitution was always weak, and he probably suffered from tuberculosis

ost of his life. The breaking off of his engagement to Marie Wodzinska in 1836 was in part caused by her parents' fear of his physical condition, in part by the thinness of his purse, and in part by peculiarities of his psychic nature. In spite of his unstable health, however, he spent the winter of 1838-1839 in Majorca with George Sand. There they lived under conditions of weather and housing which were damaging to his body, and he almost died on his return to France early in 1839. During the next few years, his increasingly rare semipublic concerts, his wavering health, and his aristocratic demeanor and sympathies combined to surround his figure with an air of legend and mystery. From 1843 to 1848, partly because he was well aware that his delicate, sensitive style of pianism could not compete with the bravura of the new school of virtuosos, he gave no concerts. His relationship with George Sand had begun to break up in 1845; it ended in 1847 with quarrels and bitter recrimination, and they were never reconciled.

Chopin made his last Paris concert appearance in the Salle Pleyel on Feb. 16, 1848. The revolution that overthrew Louis Philippe broke out a few days later, and in April the ailing composer crossed to England to escape the turbulence of a Paris he could scarcely understand. In May, he played before Victoria and Albert in London. His illness was turning grave and he was taken finally in hand by one of his pupils, an aristocratic Scotswoman named Jane Stirling. She hospitably persuaded him to spend several months in the inclement Scottish autumn, and when he returned to Paris in November 1848, he was dying. In 1849 he had to abandon all his teaching, and his financial condition was severely worsened. Jane Stirling smoothed his last weeks with a substantial gift of money, and his sister Ludwika came from Poland to nurse him. He died at 12 Place Vendôme, Paris, on Oct. 17, 1849, and was buried in Père-Lachaise Cemetery. On Oct. 30, 1850, a memorial monument designed by George Sand's son-in-law, Jean Baptiste Clésinger, was unveiled at his grave, over which earth sent from Poland was symbolically sprinkled.

An enduring story pictures Chopin as having had a love affair with Delphine Potocka. That the two were very close during his final years is suggested by her having been one of the last of his circle of friends to visit him when he was dying. To her he dedicated both the F Minor Piano Concerto and the *Minute Waltz*. But the authenticity of the Potocka correspondence, on which, for example, the picture of their complete intimacy in Kazimierz Wierzyński's *The Life and Death of Chopin* (New York 1949) is based, has been questioned, and the letters may well be spurious. Women played a very important role in Chopin's life—Constantia Gladowska, Marie Wodzinska, Delphine Potocka, and Jane Stirling among them—but he never married, and only George Sand was certainly his mistress. As a youth he had been romantically attached to several male friends, notably Titus Wojciechowski, but he was too reserved and proud to surrender himself wholly to anyone. The final impression of him is that of a man surrounded by friends, male and female, but always fundamentally alone with himself and his art.

Universal Recognition.—Chopin's position in music is unique in several ways. He is the only composer to have won universal recognition entirely for piano music: all of his compositions are

either for piano solo or include a piano part. He never composed an opera, a symphony, or an overture, and his concerted pieces for piano and orchestra were little more than juvenilia. Although he wrote a cello sonata and a trio for piano, violin, and cello, he did not cultivate chamber music. His piano compositions won for him early in his life a high reputation that endures unchanged. Adverse judgments have always been made from time to time of his weaker compositions, as well as of a vein of perfumed, self-pitying melancholy in some of the stronger ones. But Chopin has always been admired intensely by both musicians and the musical public. No other great composer has matched his ability to conquer and hold very numerous listeners without losing the esteem of his peers. His music remains the central fact in the standard repertoire of pianists.

Musical Style.—The amount of Polish influence audible in Chopin's music has been disputed. Certainly his unclassical harmonic motions, his wide rhythmic variety, and his chivalresque attitudes seem in part to have resulted from the Polish elements of his background. In his polonaises and the more than 50 mazurkas, he employed Polish dance forms, subtilizing and enriching them. Traces of Polish musical procedures are audible in several of his other compositions. But it is all but impossible to detect anything specifically Polish in a majority of the ballades, études, impromptus, nocturnes, preludes, scherzos, or waltzes, or in any of the three piano sonatas, the barcarolle, berceuse, or fantasia. For Chopin, despite his intense patriotism, was not artistically a nationalist. In quantity and in manner the body of Chopin's music is as much Western as Slavic, as much French, Italian, and Austro-German as Polish. Above everything else, it was his own: he is instantly recognizable even in isolated measures. Few artists have been original so effortlessly and completely.

Although earlier musicians had composed great music for the piano (and harpsichord), Chopin was in an important sense the first great composer of piano music. His best compositions appear to have grown organically from the instrument, so intense was his imaginative and creative response to the piano's innate qualities and capabilities. He exploited its potentialities deeply, so deeply that it can still be said more than one century later that he who can play the Chopin études can play anything. His harmonic originality greatly increased the speed with which 18th century harmonic manners decayed; influencing, among others, Liszt and Richard Wagner, it became directly ancestral to 20th century change and development. Equally effective was Chopin's example as a fashioner of novel formal patterns, necessary substitutions for 18th century forms weakened by romanticism's blurring of the harmonic logic with which they had evolved.

Bibliography.—The first important biography of Chopin was that of Frederick Niecks (1888). Later biographical and critical materials are to be found in books by Gerald Abraham, Édouard Ganche, Arthur Hedley, Ferdinand Hoessick, James Gibbons Huneker, Zdzisław Jachimiecki, Hugo Leichtentritt, William Murdoch, Ippolito Valetta, and Herbert Weinstock. The so-called *Liszt Life of Chopin* is only in part by Liszt, and in any case is of small value. No truly definitive complete edition of Chopin's music has ever been made generally available; that edited for the Oxford University Press by Édouard Ganche is the most scholarly.

HERBERT WEINSTOCK,
Author of "Chopin, the Man and His Music."

CHOPIN, chōp'in, a Scotch liquid measure containing one and one-half British pints. The chopin, in name at least, was derived from the French, with whom a similar measure was in use until the introduction of the metric system.

CHOPINE, chō-pēn', an elevated shoe or clog, now obsolete but introduced into England during Queen Elizabeth's reign, and becoming popular with ladies of the court. Shakespeare mentions them in *Hamlet* (Act II, scene 2): "B'yr lady, your ladyship is nearer to heaven than when I saw you last by the altitude of a chopine."

CHOPTANK, chōp'tānk, **RIVER**, rises in Kent County, Delaware, flows southwest into Maryland, and near the south extremity of Talbot County spreads into an estuary several miles wide and nearly 20 miles long, through which it empties into Chesapeake Bay; the total course is about 100 miles. It is navigable for sloops to the mouth of Tuckahoe Creek, a distance of about 50 miles.

CHOPUNNISH, chō-pūn'ish, or **NEZ PERCE**, a tribe of North American Indians, also known as Sahaptin, who now live on the Nez Percé Reservation, in Idaho, and on the Colville Reservation in Washington. The name Nez Percé originated from the custom formerly followed of piercing the nose. In the Nez Percé War of 1877 the tribe was under the control of Chief Joseph (q.v.), who forbade his men to interfere with any white non-combatants. See also SHAHAPTIAN INDIANS.

CHORAGIC, kō-rāj'ik, **MONUMENT**, in ancient Greece, a monument erected in honor of one who had gained a prize as choragus (q.v.), or organizer of the play and chorus. The remains of two very fine monuments of this sort are still to be seen at Athens, namely, those of Thrasylus and of Lysicrates, the last popularly called the Lantern of Demosthenes.

CHORAGUS, kō-rā'gūs, among the ancient Greeks, the musician who directed each of the choruses furnished by the 10 Attic tribes for the public festivals. (Such an office was established in Oxford University in 1626 by Dr. William Heyther, but it was soon abolished; however, in 1926 it was revived.) The person of the Greek choragus was inviolable, as well as those of the members of the chorus. The choragus who was adjudged to have performed his duty best received an ornamental tripod, engraved by a skilful artist, and bearing the name of the tribe which had gained the victory, of the citizen who had paid the expense, and of the master who had trained the choir. These tripods were set up as public monuments on pillars or other structures. A street in Athens which contained a great number of such monuments was called the Street of the Tripods. The most remarkable of these monuments yet remaining is the choragic monument of Lysicrates. (See also CHORAGIC MONUMENT; CHORUS.)

CHORAL, kō-rāl, kō-rāl', or **CHORALE**, kō-rāl' (Ger. *choral*). The term *choral* is used both as an adjective and as a noun. As an adjective it is accented on the first syllable, and means pertaining to a chorus or a choir, for example, a *choral* composition, or a *choral* soci-

ety. As a noun the word is accented on the second syllable, and in general usage the term *chor-al'* (without the final e) refers to the plain song of the Catholic Church, in German called *Gregorianischer Choral* (see PLAIN SONG and also GREGORIAN CHANT). The term also designates the hymn tunes of the German Protestant Church, and in this sense it is generally spelled in English with the final e. This form of chorale was introduced by Martin Luther in the early part of the 16th century. The hymns were written by Luther in the vernacular, founded on the simpler tunes, and arranged to music which was more rhythmic than that in general use. This change appealed to the people and brought out the power of music to kindle religious emotion. This change also had a great effect upon church music throughout Germany, and within a short time after its introduction a literature of remarkable dignity, simplicity and earnestness was produced. During the 16th and 17th centuries many excellent examples of chorales were brought forth, probably the most important, though not the first, of the early collections being the *Enchiridion*, or handbook, published by Luther and his friend Johann Walther, at Erfurt, in 1524. This book contained a preface by Luther himself, and was undoubtedly the foundation for the extensive number of collections which continued to appear till the latter part of the 17th century, but which, for many reasons, religious as well as political, ceased to be popular shortly after that time. Chorales were generally accompanied on the organ, and this custom, together with that of playing and writing so-called figured chorales, soon led to a greater development of harmony and counterpoint, so that the art of playing became of first importance to the successful singing of the chorale.

Many of the chorales were original, many were revisions of old church tunes, and some were adapted from altogether secular sources. Of these latter, the most famous collection was that of Claude Goudimel, published in Paris in 1565, the majority of which were soon incorporated into the German collections, and one of which, "Old Hundred," became very popular in England. Others taken from secular sources are "Herr Christ der einig Gott's Sohn," taken from "Ich hört ein Fräulein klagen," and "Herzlich thut mich verlangen," which appears several times in Bach's "Matthäus-Passion," taken from "Mein Gemuth ist mir verwirret." On the other hand, there are many based upon church tunes, such as "Der du bist drei in Einigkeit," taken from "O beata lux Trinitatis."

The authorship of many chorales is, however, obscure and uncertain, such as the "Es ist gewisslich," generally attributed in England to Luther. There is doubt of his authorship even of the famous "Ein feste Burg ist unser Gott" which has been incorporated into the compositions of Meyerbeer in "The Huguenots," of Mendelssohn in his "Reformation Symphony," of Wagner in his "Kaiser Marsch," and of Bach in one of his cantatas. One of Johannes Crüger's chorales, "Nun danket alle Gott," became well known in England from its incorporation in Mendelssohn's "Lobgesang."

Today the chorales are best-known through their harmonizations by Johann Sebastian Bach.

CHORAL SOCIETIES. A choral society is a body of singers formed for the purpose of

studying and performing choral works. Until comparatively modern times chorus singers were generally professional musicians, and the chorus that took part in the production of an oratorio did not usually number over 40.

Today choral societies consist of amateurs as well as professionals and are much larger than their predecessors, an average chorus numbering 150 to 200 voices. It is possible that the magnificent effect of the chorus formed to celebrate the commemoration of Handel's birth by performances given in Westminster Abbey and the Pantheon in London in 1784 may have been a great factor in the formation of choral societies in England. This chorus was the largest that had ever been formed up to that time. It numbered 274 and the orchestra 251. At a subsequent festival in 1791 the chorus and orchestra were said to have numbered over 1,000, while for the Handel Festival held in the Crystal Palace in London in 1874 the chorus numbered 3,200 and the orchestra over 500. In America mammoth choruses for festivals have sometimes numbered many thousands; perhaps the largest was the chorus of 20,000, accompanied by an orchestra of 2,000, which sang at the World Peace Jubilee in Boston in 1872.

It is doubtful whether such a large body of singers and players is materially more effective than a smaller one. The impression on first hearing an enormous chorus is nearly always one of disappointment at the volume of sound. The explanation is made that the large hall necessary for such a large chorus and audience causes a loss of quantity of tone, but this is disproved by comparisons made at a Saengerfest held in Philadelphia, Pa. Here the effect of the entire mass chorus of 5,000 male voices was not much greater than that of a single society of 250 voices. There was a difference, of course, but the volume was not 20 times greater, not even twice as great.

A well-balanced chorus of from 200 to 500 voices is now generally acknowledged to be more effective and much easier to command than the overgrown chorus assembled for a festival. Choruses of this size are numerous in the United States, Germany and England, where choral work, both religious and secular, is highly appreciated and supported.

The Berlin *Singakademie*, still in existence and world-renowned, was founded in 1791 with 27 members and now numbers 600. Felix Mendelssohn was a guest conductor in 1829.

In Great Britain choral music has long been an important part of the musical life of the nation. In London and the provincial cities the choral societies include the Royal Choral Society, the British Broadcasting Corporation Choral Society, the Newcastle-upon-Tyne Bach Choir, the Handel Society, the London Choral Society, the Birmingham City Choir and Festival Choral Society, the Cambridge University Musical Society, the Hull Choral Union, the Manchester Hallé Society, the Leeds Choral Union, the Oxford Bach Choir, the Edinburgh Royal Choral Union, the Glasgow Choral Union and the Glasgow Orpheus Choir. In Ireland there are the Belfast Philharmonic Society and the Dublin University Choral Society.

In the United States a singing class founded by William Billings became the Stoughton (Mass.) Musical Society in 1786 and continued into the 20th century as the oldest choral society

in the country. Next in order of age, and of greater size and importance, was the Handel and Haydn Society of Boston, founded in 1815, and today one of the most important choral societies in the world. Until 1847 the elected president of the society acted as its conductor, but at that time it was felt that the engagement of a permanent professional conductor would raise the musical standards of the society. Its most outstanding conductors have been Charles Edward Horn (1848-1849), Carl Zerrahn (1854-1895), Reinhold Ludwig Herman (1898-1899), Emil Mollenhauer (1899-1927), and Thompson Stone (1927-). Another important Boston choral group, the Cecilia Society, was formed in 1874 under the patronage of the Harvard Musical Association, and in 1876 became an independent organization. Its conductors have included Benjamin Johnson Lang (1874-1907), Wallace Goodrich (1907-1910), Max Fiedler (1910-1911), Arthur Mees (1911-1915), Chalmers Clifton (1915-1917), Arthur Shepherd (1917-1918), Georges Longy (1918-1919), Ernest Mitchell (1919-1920), Agide Jacchia (1920-1924), Malcolm Lang (1924-1926), and more recently Arthur Fiedler, Victor Manusevitch and Alfred Nash Patterson.

In New York a number of choral societies, the Handel and Haydn, the New York Choral Society and the New York Sacred Music Society, dating from 1824 to 1849, fostered the taste for choral music. After this for more than 20 years no long-continued effort was made to carry on the work, until in 1873 Dr. Leopold Damrosch founded the New York Oratorio Society which, beginning with about 60 members, now numbers nearly 300. Walter Damrosch, son of Dr. Leopold Damrosch, succeeded him as conductor in 1885 and continued until 1898 when he was in turn succeeded by his brother Frank Damrosch who served from 1898 to 1912. Subsequent conductors have been Louis Koemmenich (1912-1917), Walter Damrosch (1917-1922), Albert Stoessel (1922-1943), Albert Greenfield (1943-).

Another important choral society in New York is the Schola Cantorum, consisting of professional singers, and distinguished for its introduction of new choral works and music which is not often heard. From 1909 to 1912 this organization was known as the MacDowell Chorus, sponsored by the MacDowell Club of New York. In 1912, it assumed its present name. Kurt Schindler conducted the organization from 1909 to 1927, and since then it has been conducted by Hugh Ross.

In other large cities of the nation the famous choral societies have been: in Philadelphia the Haydn, the Harmonic, and the Cecilia societies, and the Philadelphia Chorus; in Baltimore the Oratorio Society; in Washington the Choral Society; in Chicago the Apollo Club; and in Grand Rapids the Saint Cecilia Society.

Many of the great choruses of the nation are assembled and trained for annual music festivals in various cities. The outstanding ones have been the Cincinnati May Festival chorus, organized by Theodore Thomas in 1873; the Worcester (Mass.) Music Festival, sponsored by the Worcester County Musical Association, founded in 1871; the Ann Arbor (Mich.) May Festival, which had its inception in a choral union organized in 1879 by the University (of Michigan) Musical Society. The first actual festival was given in May of 1893.

Special mention should be made of the Bach Choir of Bethlehem, Pa., organized in its present form by John Frederick Wolle in 1898. The city of Bethlehem has a long music history. As early as 1742 the Moravian settlers held a "singstude" and from 1744 a Collegium Musicum was maintained, which was succeeded in 1820 by a Philharmonic Society. In 1882 Wolle organized the Bethlehem Choral Union, which in 1892 gave the first United States performance of Bach's *St. Matthew's Passion* in its entirety. In 1900 the Bethlehem Bach Choir was organized and continued until 1905 when Wolle moved to California. He returned to Bethlehem in 1911, and the work of the choir was resumed with the financial assistance of Charles M. Schwab, the steel magnate. Wolle continued as conductor until his death in 1933. He was succeeded by Bruce Carey who served until 1938, when Ifor Jones became conductor. Originally the festivals (lasting for two days in May) were held in the Memorial Church, but since 1912 they have been given in the Packer Chapel of Lehigh University. At each festival Bach's *B Minor Mass* is performed, and the original choir of 80 has grown to almost 300.

CHORALE. See CHORAL; CHORAL SOCIETIES; MUSIC; GREGORIAN CHANT.

CHORALE PRELUDE. An instrumental composition (generally for organ) based on a Protestant chorale, and intended for performance before the singing of the chorale by the congregation.

CHORAZIN, kō-rā'zīn, city, Palestine, in which Christ's mighty works were done, but named only in his denunciation (Matthew 11:21; Luke 10:13). It was known to Saint Jerome, who describes it as on the shore of the Sea of Galilee, two miles from the ruined city of Capernaum. Some locate it at the modern Tell Hum, three miles northeast of Capernaum, but this location is doubtful. Though the town was evidently of some importance, judging from the extensive ruins to be seen there, it has received little or no attention in ancient writings.

CHORD. 1. *In music*, the simultaneous sounding of several tones. Harmonically, the basic chord is the triad of three tones, formed by adding two tones to the basic tone or root, each a third above the other. Thus the major triad on C consists of C, E and G, representing the intervals of a major third (C-E) and above it a minor third (E-G). The minor triad on C consists of C, E flat, and G, or a minor third (C-E flat) and above it a major third (E flat-G). A diminished triad consists of three tones forming two minor thirds (C-E flat-G flat). The consonant chords are the major, minor, and diminished triads of any key or tonality and their inversions, an inversion being formed by using as the lowest tone of a chord a tone other than its actual root (i.e. in the C major triad using E as the lowest tone) thus forming the *sixth* chord (G-C-E), or second inversion.

Dissonant chords are formed by adding further tones, each a third above the triad. Thus a seventh chord is formed by the root, the third, the fifth, and the seventh tones, the seventh being a third higher than the fifth. In the key of C major, the seventh chord on G is G,B,D, and F. Since G is the fifth tone of the scale in the key

of C, and since the fifth tone of the scale is known as the dominant, the seventh chord on G is known as the dominant seventh of the key of C. Inasmuch as each seventh chord consists of four tones, it is capable of three inversions—the *six-five-three* chord (in the case of the dominant seventh of C—B,D,F,G); the *six-four-three* chord (D,F,G,B), and the *six-four-two* chord (F,G,B,D). Seventh chords may be formed on any tone of the scale. The dominant seventh, on the fifth of the scale, is known as a primary seventh chord, since its resolution to the tonic triad (formed on the tonic, or key-note of the scale) results in what is known as a perfect cadence, giving a final and satisfactory conclusion to a phrase, or to a composition. Seventh chords on the tones other than the dominant tone of the major scale are known as secondary seventh chords. The diminished seventh chord is one in which the tones of the chord are a minor third apart, and the extreme tones of the chord are a diminished seventh apart. The diminished seventh chord is formed on the fourth, sixth and seventh tones of the harmonic minor scale—in C minor, F, A flat, B, D; A flat, B, D, F, and B, D, F, A flat.

The addition of a fifth tone to the seventh chord, a third above the seventh, forms a ninth chord. Thus, the addition of an A to the dominant seventh chord on C major forms a dominant ninth chord—G, B, D, F, A. Similarly, the addition of further superimposed tones at the interval of a third will produce eleventh and thirteenth chords, each having its name from the fact that its highest tone is an eleventh or a thirteenth above its root. (For the principles of chord progression, see HARMONY.)

2. *In geometry*, a chord is the straight line which joins the two extremities of the arc (q.v.) of a curve; so called from the resemblance which the arc and chord together have to a bow and its string, the chord representing the string. The chord of a circular arc is obtained by multiplying the radius by twice the sine of half the angle which the arc subtends at the center.

CHORDATA, kōr-dā'tā, a primary division or phylum of the animal kingdom comprising those animals which have, at least in early developmental stages: (1) a notochord (q.v.), hence the name of the phylum; (2) a dorsal tubular nerve cord; and (3) pharyngeal gill slits. Groups included as subphyla are Vertebrata (formerly considered a phylum), Cephalochorda (*Amphioxus*), Urochorda or Tunicata, and, somewhat doubtfully, the Hemichorda (*Balanoglossus*). See especially VERTEBRATA.

CHOREA, kō-rē'ā, or **SAINT VITUS' DANCE**, is a disease of the central nervous system characterized by disturbances of spontaneous and co-ordinating movements. It occurs usually in the later years of childhood or less frequently the earlier years of adolescence and is twice as common in girls than in boys. The motor symptoms vary from slight unrest and irritability to marked disturbances. In mild cases the choreic movements are limited to the face and to single muscles, in more severe ones the entire body musculature may be involved. The movements in the incipient stage are often scarcely noticed. There are at first slight irregular, jerky movements with a tendency to drop articles, due to a relaxation of grasp occurring simultaneously.

with the muscular jerk. There are also premonitory symptoms of listlessness, insomnia, nervous irritability, loss of appetite, and sometimes anemia. Psychic manifestations may accompany the development of the chorea in the form of night terrors, transitory hallucinations, all of which are only temporary and belong to the less severe forms. Distinct delirium, stupor, and acute dementia belong only to the severe form for which the prognosis is unfavorable. The usual course of chorea is from 6 to 10 weeks, but not infrequently it extends over three or four months, or the movements may persist for many months due to the nervous condition of the child. Recurrent attacks are also frequent. All of this points to a broader view of the causation than is usually accepted. There is fundamentally present, probably, an inferior or slowly developing psychomotor-cerebellar integration, which is inadequate to the grade of motor adaptation demanded by the rapidly growing body. Choreia therefore a fatigue symptom arising from a slight degree of infection or even from mere excess of motor activity. Rheumatic and other infections aid in reducing the physiological efficiency, but probably have not the specific etiological value that has been assigned to them. Neonatal syphilis, by interfering with the normal development of the nervous system, is a causative factor in certain choreas.

The best treatment for chorea is rest in bed during course of the active symptoms. Excitement of all kinds, play, or intellectual effort should be avoided. There should be a full nourishing diet and during convalescence gentle exercise in the open air. A solution of arsenic was once in frequent use as a remedy as was the intravenous administration of neosalvarsan, but the use of sulphur drugs and fever therapy is now generally approved. In chronic chorea much can be done in overcoming the persistent motor disturbance by judicious training through passive and voluntary movements under guidance. The voluntary movements are very simple at first and gradually become more complex, thereby assisting in establishing once more freedom and precision of movement through coordination.

There are also habit choreas which may be hysterical imitation or may be milder forms of convulsive tics, from which, however, true chorea can be differentiated. There are also choreas appearing in adults. The most serious of these is the chorea of pregnancy. It usually occurs with the first pregnancy and may recur with succeeding pregnancies. It soon ceases after the termination of the pregnancy. (For hereditary chorea see HUNTINGTON'S DISEASE.) The name St. Vitus's Dance was acquired from a dancing mania common at one time in Germany and which was said to be cured by pilgrimages to the shrine of St. Vitus. The name has been retained although chorea is an entirely different affection from those outbreaks of mental and physical excitement.

Consult Jelliffe, S. E., and White, W. A., *Diseases of the Nervous System*, 6th ed. (Philadelphia 1935).

SMITH ELY JELLIFFE.

CHOREOGRAPHY, a system of dance notation, the art of teaching the steps of a dance by written signs. Evidence of its use has been found in Egypt, and the figure dances of ancient Greece were chalked on the floor in signs, that the dancers might learn them. See also BALLET.

CHORION, kō'ri-ŏn, in embryology and natural history, a term denoting an anatomical structure found in connection with the developing embryo. The chorion is the outer covering of the fetus *in utero*. The term is also used in zoology to denote the external protective membrane which covers the eggs of different animals, especially those of insects.

CHORLEY, chōr'li, Henry Fothergill, English music critic, poet, and novelist: b. Blackley Hurst, Lancashire, Dec. 15, 1808; d. London, Feb. 16, 1872. He became a contributor to the *Athenaeum* in 1830, and in 1833 he joined its staff as literary and musical reviewer, displaying fine perception and exquisite taste in his work; he retired in 1868. His finely written novels, many of them under the pseudonym Paul Bell, made small appeal to public tastes, and his plays, with the exception of *Old Love and New Fortune*, are weak. While his verse was graceful and witty, it was highly artificial. His books included: *Music and Manners in France and North Germany* (1841); *Pomfret* (1845); *Modern German Music* (1854); *Roccella* (1859); *Thirty Years' Musical Recollections* (1862); *The Prodigy* (1866); *Duchess Eleanor* (1866).

CHORLEY, municipal borough, England, in Lancashire, 19 miles west-northwest of Manchester. The manufacture of cotton goods is the principal industry, and there are also railway carriage works, and metal foundries. In the vicinity are coal, lead, and iron mines, and millstone quarries. Pop. (1947 est.) 32,090.

CHOROID or **CHORIOID**, one of the four principal coats of the eyeball. See *EYE—Anatomy and Physiology*.

CHORON, shō-rōn', Alexandre Étienne, French musician and writer on music: b. Caen, Oct. 21, 1772; d. Paris, June 29, 1834. Besides being a talented musician, he was an excellent scholar, linguist, and mathematician. He became a music publisher in 1805, and for some years published the works of the best masters. During 1816-1817 he was director of the Paris Opera, and he then founded the École de Musique Classique et Religieuse, which he headed until 1830. He composed a song entitled *La Sentinelle* which achieved wide popularity in France. His writings included *Principes de composition des écoles d'Italie* (1808) and *Dictionnaire historique des musiciens* (with F. J. M. Fayolle, 1810-1811). He did not complete his most ambitious work, *Introduction à l'étude générale et raisonnée de la musique*.

CHORUS, originally a special feature in the Greek drama. During the most flourishing period of Attic tragedy the chorus was a troupe of male performers, wearing masks and representing male or female characters, who, during the whole representation, were spectators of the action. In the intervals of the action the chorus chanted songs relating to the subject of the performance and which were intended either to augment the impression or to express the feeling of the audience on the course of the action. Sometimes it even took a direct part in the action by observations on the conduct of the dramatic characters, by advice, consolation, exhortation, or dissuasion. It usually represented a

part, generally the oldest portion of the people, where the action happened, sometimes the counselors of the king. The chorus was an indispensable part of the representation. In the beginning it consisted of a great number of persons, sometimes as many as 50; but the number of the tragic chorus was afterward limited to 15; while the chorus in comedy numbered 24. The exhibition of a chorus was in Athens an honorable civil charge, and was called choragy. (See CHORAGUS). The leader or chief of a chorus was called coryphaeus, who spoke in the name of the rest when the chorus participated in the action. The chorus was often divided into two parts, who sang alternately. The divisions of the chorus were not stationary, but moved from one side of the stage to the other; from which circumstance the names of the portions of verse which they recited, *strophe*, *antistrophe*, and *epode*, are derived. But it cannot be determined in what manner the chorus sang. It is probable that it was in a sort of solemn recitative, and that their melodies, if we may call them so consisted in unisons and octaves, and were very simple. They were accompanied by flutes. With the decline of ancient tragedy the chorus was omitted. Some modern tragedians, as Jean Baptiste Racine (q.v.) in France and Johann C. F. von Schiller (q.v.) in Germany, attempted, with more or less success, to imitate or revive the Greek chorus. Shakespeare employed devices founded on it.

Chorus, in modern music, is that part of a composite vocal performance which is executed by the whole body of the singers, in contradistinction to the solo airs and concerted pieces for selected voices. The singers themselves are also called the chorus.

CHORZOW, kó'zhöf, Poland, city of the province of Slask (Silesia or Schlesien), 110 miles southeast of Breslau (Wrocław) and 5 miles south of Beuthen (Bytom); it is known also as KROLEWSKA HUTA and, in German, KÖNIGSHÜTTE. The city is situated in the rich coal, zinc, and iron mining district of Katowice. Its chief industry is in its great smelting works, with allied ammonia, tar, and benzine plants, and iron and steel foundries and puddling and rolling mills; there are also important glass and brick works. Chorzow was founded in 1797, at which period the province formed part of the kingdom of Prussia; it was transferred to Poland as the result of a plebiscite taken in 1921. Pop. (1945 est.) 112,000.

CHOSE, shōz, *in law*, a thing, a chattel, a piece of property; the subject matter of an action. Chose is used in divers senses, of which the four following are the most important: *Chose local*, a thing annexed to a place, as a mill; *chose transitory*, that which is movable, and may be taken away or carried from place to place; *chose in action*, otherwise called *chose in suspense*, a thing of which a man has not the possession or actual enjoyment, but has a right to demand by action or other proceeding; *chose in possession*, a thing which a person has not only the right to enjoy, but also its actual enjoyment.

CHOSEN, chō'sen, name in Japanese for the Asiatic peninsula of Korea (q.v.).

CHOSROES. See KHOSRAU.

CHOU EN-LAI, jō'ēn'li', Chinese Communist leader: b. Huaiyin, Kiangsu Province, 1898. Son of a mandarin family, he was educated in Japan, at Waseda University, and in Tientsin, at Nankai University; for his part in leading a student rebellion in Tientsin in 1919 he served 12 months' imprisonment. He continued his studies in Paris during 1921-1922, and in Germany in 1923, and following his return to China he helped organize the Chinese Communist Party. Joining Sun Yat-sen (q.v.) at Canton in 1924, he became director of political training at Whampoa Military Academy, of which Chiang Kai-shek (q.v.) was the president, and for the next two years, under direction of the Kuomintang, organized Communist strikes in north China. In 1927 he directed seizure of Shanghai by Nationalist forces, but came into conflict with Chiang Kai-shek and narrowly escaped being put to death. From this time Chou was one of the most powerful of the leaders of the Chinese Communists, commanding Red armies which fought first the forces of Chiang Kai-shek and, subsequently, the Japanese invaders of China. Civil war broke out again, however, before Japan had been defeated, and in 1944, Chou was head of a Communist delegation which conferred with Gen. Patrick Jay Hurley in mediation proffered by the United States. In 1946 he was one of the signatories of an agreement designed to terminate the conflict, but fighting once more ensued.

CHOUAN, shwän, member of a band of royalist peasantry of western France, who carried on a petty warfare against the republican government from an early period of the French Revolution. The name Chouan was finally extended to all the Vendéans. The name was derived from the first chief of the Chouans, Jean Cottureau (1757-1794), who with his three brothers organized these bands in 1792, under the inspiration of the Marquis de la Rouerie (see CHARLES TEFFIN ARMAND), an ardent leader of the Royalists. Cottureau was the son and grandson of persons engaged in the manufacture of wooden shoes. He had joined a band of dealers in contraband salt, and acquired the surname Chouan from the cry of the screech owl (*chathuant*), which he used as a signal with his companions. He was killed in an engagement with the Republican troops, July 28, 1794. After the death of Jean Cottureau, the Chouans became quite lawless, engaging in guerrilla warfare and highway robbery. About 1800 they ceased to rob and terrorize, and although an effort was made in 1815 to revive the insurrection, they were suppressed by Gen. Maximilien Lamarque (1770-1832). See also VENDÉE.

CHOUANS, *The*, a romance by Honoré de Balzac (q.v.), the novelist's first important work. The title, when it appeared in 1829, was *The Last Chouan; or, Bretagne in 1800*. In 1846 it was rearranged in its present form. The author made a profound study of the scenery of Bretagne (Brittany) and the manners of its people before he wrote his romance, and his pictures of both scenery and people have the stamp of reality and truth.

CHOUSINGHA, chou'sing-hä, a gazelle-like Indian antelope, remarkable for the fact that

the buck has four horns. See also **FOUR-HORNED ANTELOPE**.

CHOUTEAU, (René) Auguste, cofounder of Saint Louis and fur trader: b. New Orleans, La., September 1749; d. Saint Louis, Feb. 24, 1829. The eldest son of René Auguste Chouteau and Marie Thérèse Bourgeois Chouteau, in August 1763 he left New Orleans for the Illinois Country as clerk to Pierre LaClède, who with others had obtained a grant of the fur trade on the Upper Mississippi. In December LaClède chose for his trading post the site of Saint Louis and later sent 14-year-old Chouteau with 30 men to begin construction (Feb. 15) of the first building. Until 1768 Chouteau continued as assistant to LaClède, thereafter operating as his partner. Following LaClède's death (1778) Chouteau emerged as the citizen of first importance. According to William Henry Harrison (1805) he was "without doubt the first of the Louisianians, Upper, or Lower." Though he held no office he was much consulted by Spanish officials, particularly in regard to the important Osage tribe, whose trade for many years he controlled with his brother Pierre (q.v.). After the transfer of Louisiana he served as judge of the Court of Common Pleas and Quarter Sessions, justice of the peace, president of the first Board of Trustees of St. Louis, member of the legislative council of Missouri Territory, lieutenant colonel of militia, and United States Commissioner for various Indian treaties. He married Marie Thérèse Cerré, by whom he had four sons and three daughters.

CHOUTEAU, shō-tō', Auguste Pierre, fur trader and Indian treaty commissioner: b. Saint Louis, Mo., May 9, 1786; d. Fort Gibson, Okla., Dec. 25, 1838. The eldest son of Pierre Chouteau (q.v.) and Pelagie Kiersereau Chouteau, he was appointed to the United States Military Academy by Thomas Jefferson in 1804 and was graduated on June 20, 1806, fourth in a class of fifteen. He served briefly as ensign in the 2nd Infantry on the southwestern frontier, resigning Jan. 13, 1807, to take his place in the family business. In that year he led a fur trade expedition up the Missouri which was prevented from reaching its destination among the Mandans by the hostility of the Arikaras. Two years later, as a partner in the newly-founded Saint Louis Missouri Fur Company he again ascended the Missouri and wintered in the Dakotas. During the War of 1812 he served as captain of militia. In 1815 with Jules de Mun he led a considerable party of trappers to the Colorado mountains; in the course of this expedition he battled several hundred Pawnees on an island in the Arkansas which has since borne his name. In 1817 Chouteau and De Mun were imprisoned by the Spanish at Santa Fe and their property worth more than \$30,000 was confiscated. Through his father young Chouteau's trading contacts with the Osage had begun soon after he left the army. Now, on his return to Saint Louis, he concentrated on the Osage trade, at first through a resident partner (1817), and presently through posts which he personally supervised, the chief of which were on the Saline and the Neosho rivers (1822), and near the mouth of the Verdigris (1823). During the remainder of his life the United States government as well as the Indians looked on him as the friend and adviser of the tribes near Fort

Gibson. He served frequently as commissioner for Indian treaties and in his last years was employed in negotiating with the Comanches. On an expedition to the Comanche country he had the accident which led to his death. He married his cousin Sophie Labbadie of St. Louis, Feb. 15, 1809, by whom he had one son and six daughters.

JOHN FRANCIS McDERMOTT,
Professor, Department of English, Washington University, St. Louis, Mo.

CHOUTEAU, (Jean) Pierre, fur trader and Indian agent: b. New Orleans, La., Oct. 10, 1758; d. Saint Louis, Mo., July 10, 1849. In September 1764 he arrived with his mother and sisters at Saint Louis where his brother Auguste (q.v.) was then clerk to Pierre LaClède. In 1794 the brothers obtained an exclusive grant of the Osage trade for eight years and Pierre built Fort Carondelet in western Missouri where he commanded with rank of lieutenant of militia. He may have been responsible for the removal of 400 Osage to the Arkansas River in 1802 when the monopoly was given to rival merchants; there is no evidence, however, that he ever maintained a trading post in Oklahoma. In 1804 he was named United States Indian agent for all tribes west of the Mississippi; later he was for years agent for the Osage. In 1809 he organized with others the St. Louis Missouri Fur Company and commanded the expedition which returned Shahaka to the Mandans. He served as captain and major of militia, justice of the peace in St. Louis, and as one of the first trustees of the town. His sons by his first wife were Auguste Pierre (q.v.); Pierre, Jr., eventually head of the American Fur Company; and Paul Ligest, for many years a United States Indian agent. François, eldest son by his second wife, established a trading post on the site of Kansas City in 1821.

CHOWCHOW, chou'chou, **CHOW**, or **CHOW-CHOW**, a diminutive breed of Siberian sledge dogs, improved and developed in China, whence they began to be imported into Europe and America at the beginning of the 20th century. These dogs have the form and coat of their more useful progenitors (dense, straight, rather coarse in texture, with a soft woolly undercoat), and are compact and sturdy of frame. See also **Dog**.

CHOWCHOW, a Chinese or pidgin English word meaning chopped up or broken and mixed. It is applied to a confection of mixed fruits made in China; to a mustard pickle of assorted ingredients made in India; in the United States and Great Britain to a similar pickle usually compounded of chopped cabbage, green tomatoes, green or red peppers, spices, vinegar, mustard seed, and cucumbers.

CHOWDER, chou'dér (French *chaudière*, "kettle"), a dish of French origin, composed chiefly of vegetables, pork, and fish or shell-fish, boiled together. Perhaps the most common form of chowder is that made from clams, either from the soft-shelled variety or the hard-shelled round clam or quahog. Chowder is a favorite dish on the New England coast and among the Newfoundland fishermen. A fish chowder is made as follows: salt pork cut into small strips or dice is cooked for a few minutes in a deep

kettle. Sliced or chopped onions are slightly browned in the pork fat, and onions and pork are then removed. A layer of sliced potatoes is laid in the kettle, then a layer of fish (small ones entire or large fish in slices), a layer of salt pork, one of onions, and so on alternately to the requisite amount. The fried salt pork and onions are also distributed through the mass, which should be seasoned throughout with salt, pepper, thyme, and savory. A very common ingredient is ship bread or other hard crackers laid in between the other layers. A small quantity of water or milk, or of both, is poured into the kettle, and the whole is boiled, without stirring, until cooked through. In adding the water or milk it must be remembered that chowder is a stew, not a soup. Foreign cooks make a soup of clams, potatoes, onions, and tomatoes, which passes under the name of clam chowder. Genuine chowder is never disturbed until it is served, and in camps is portioned out in layers, direct from the kettle.

CHOWN, choun, **Samuel Dwight**, Canadian clergyman: b. Kingston, Ontario, Canada, April 11, 1853; d. Toronto, Jan. 30, 1933. He was educated at Victoria University in Cobourg, Ontario (now at Toronto), which conferred on him the degree of doctor of divinity in 1898. Ordained a Methodist minister in 1879, during the succeeding 25 years he had charge of important congregations in Montreal, Toronto, and other cities. His influence was a major factor in bringing about the union of the Methodist with the Presbyterian and the Congregational churches in 1925, to form the United Church of Canada. On this achievement he based his *Story of Church Union in Canada* (1930).

CHRETIEN DE TROYES (also **CHRESTIEN DE TROYES**), krā-tyān' dē trwā', French poet: b. probably in Champagne, France, about 1130; d. about 1180. A native of northern France, Chrétien was one of the first trouvères to compose in the lyric style of the troubadours of southern France. Among his earlier works, now lost but for some fragments in imitation of Ovid, were adaptations of the classical stories of Thebes, Troy, and Rome. He is chiefly known, however, as one of the first writers to create romantic narrative poems dealing with the knights of King Arthur's Round Table. His five extant Arthurian poems, in chronological order, are: *Erec et Enide*; *Cligès*; *Lancelot or le Roman de la charrette* (sometimes written as *Le Chevalier de la charrette*); *Ivain ou le Chevalier au lion* (sometimes written as *Yvain, ou le Chevalier au lion*); and *Perceval or Conte du Graal*, one of the first literary versions of the legend of the Holy Grail. He is believed to have died before completing this last work. See also **ARTHURIAN ROMANCES**.

Consult Comfort, W. W., *Arthurian Romances and Chrétien de Troyes* (London 1913); Loomis, R. S., *Arthurian Tradition and Chrétien de Troyes* (New York 1949).

CHRISM, krīz'm, a mixture of olive oil with balm, blessed by a bishop and used in the Roman Catholic Church and the Greek Church in the administration of the sacraments of baptism, confirmation, ordination, and extreme unction; and in such rites as the consecration of churches, altars, chalices, and baptismal water. The chrism of the Greek Church is compounded of olive oil and a great variety of spices and perfumes. In the Roman Catholic Church the holy oils are

blessed by a bishop on the Thursday of Holy Week.

CHRISOM, krīz'ūm, the name of the white linen cloth laid by the priest on the child in Roman Catholic baptism in medieval times to signify the child's innocence. The cloth was generally presented by the mother as an offering to the church, but if the child died before the mother was churched, it was used as a shroud. By a common abuse of words, chrisom came to mean the child itself, being first applied in the old bills of mortality to denote such children as died within the month of birth.

CHRIST (from Gr. *Christos*, anointed; equivalent to Hebrew *Māshiah*), the term applied to Jesus of Nazareth as the Messiah (q.v.).

CHRIST, Jesus. See **JESUS CHRIST**.

CHRIST, krīst, **Wilhelm von**, German classical philologist: b. Geisenheim, Hesse-Nassau, Germany, Aug. 2, 1831; d. Munich, Feb. 8, 1906. He was a professor at the University of Munich from 1860 to 1902. His *Geschichte der griechischen Literatur bis auf die Zeit Justinians* (1888; 5th ed. 1908) has long been a standard history of Greek literature. Among his numerous other works are *Metrik der Griechen und Römer* (1879); editions of the *Iliad* (1884); *Pindar* (1887); and the *Poetics* (1878) and *Metaphysics* (1895) of Aristotle.

CHRIST, Disciples of. See **DISCIPLES OF CHRIST**.

CHRIST CHURCH, largest of the 33 colleges, halls, and societies of Oxford University England. In 1524, Thomas Cardinal Wolsey obtained from Pope Clement VII a bull allowing him to convert the monastery of St. Frideswide into a college, to be called Cardinal College which he intended to endow on a magnificent scale. On the fall of Wolsey in 1529, this foundation came into the hands of Henry VIII. In 1532, Henry re-established it under the name of King Henry VIII's College, but again suppressed it in May 1545, and a year and a half later (Nov. 4, 1546) re-established it once more by letters patent under the name of The Cathedral Church of Christ in Oxford of the Foundation of King Henry the Eighth, with a dean and 8 canons, 100 students, 8 chaplains, and clerks, choristers, an organist, and a schoolmaster. He appointed public professors of divinity, Hebrew, and Greek.

The original foundation has been considerably modified since its creation. According to the present statutes, which came into force in 1926, the governing body consists of a dean, who is the dean of the Anglican diocese of Oxford as well as the head of the college; 6 canons (of the cathedral of the diocese; 5 being university professors of theology); and a body of students (equivalent to fellows, that is, teachers, in other colleges). In 1952, there were 51 students, 8 lecturers, 3 chaplains, 14 choristers, and an organist; in that year there were 659 undergraduates.

The original buildings were added to and rebuilt as the college expanded through the 17th and 18th centuries. Dean Henry George Liddell, who introduced the spirit of reform during his term (1855-1891), was responsible for the res-

ration of and further additions to the college buildings. The buildings about the great quadrangle include the cathedral, which is the smallest in England and is also the college chapel, and the hall, which, with the exception of the hall of William II in Westminster Palace, is the best example of its kind in England. Tom Tower, designed by Sir Christopher Wren to hold the bell Great Tom, was erected about 1682 and one of the landmarks of Oxford.

Commonly referred to as "the House" (*Aedes christi*), Christ Church is one of the foremost colleges of Oxford and has always been famous for its distinguished members. Among these may be mentioned several prime ministers of England, including, in the 19th century, George Canning, Sir Robert Peel, William E. Gladstone, Robert Arthur Talbot Gascoyne-Cecil, 3d marquess of Salisbury, Archibald Philip Primrose, 5th earl of Rosebery; and viceroys of India including Charles John Canning (Earl Canning). Other illustrious names connected with the college are Ben Jonson, John Locke, William Penn, John and Charles Wesley, John Ruskin, King Edward VII, and Anthony Eden.

Consult Thompson, H. L., *Christ Church* (London 1900); Hiscock, W. G., *A Christ Church Miscellany* (Oxford 1946); Trevor-Roper, H. R., *Christ Church* (Oxford 1950).

CHRIST IN ART. The representations of the person of the Saviour, which for a succession of ages have constituted one of the most important subjects of Christian art and have occupied the highest genius of Christendom, are all ideal. The attempt to represent the personal appearance of the Saviour probably cannot be traced back farther than the age of Constantine (4th century A.D.). The origin of Christian art has been traced to the catacombs of Rome, and is not to be considered as springing directly from pagan art, although the great Italian masters of the Middle Ages may have derived much instruction from classical models; but the painting and sculpture of the early Christians were chiefly allegorical, representing the moral of the gospel parables or similar symbolic representations of Christian doctrine, without regard to historical accuracy of portraiture. At a later period legends arose that various likenesses of the Saviour had been preserved by miraculous means. For example, King Abgar of Edessa had a napkin sent him by the Saviour himself, in which the Saviour had caused his likeness to be miraculously impressed by placing his face in it. A portrait is said to have been similarly impressed on a handkerchief of St. Veronica, and St. Luke is said to have taken one himself.

One of the earliest professed portraits of the Saviour is in the Catacomb of Callistus near Rome. He is represented with the hair parted on the forehead, and falling over the shoulders in long waving locks. In regard to this common representation it may be observed that when St. Paul wrote his first Epistle to the Corinthians, there were probably many Christians scattered over the world who remembered the personal appearance of the Saviour; therefore, if this representation had been correct, Paul would hardly have written to a Christian church that it was contrary to nature and a shame for a man to have long hair.

The great painters of the Middle Ages, to whom we owe the ideal representation of Christ, probably founded their works somewhat upon these early notions. A Christ of the 4th century

with an oval face, Oriental features, parted hair, and a short straight beard is said to have been the model for the Byzantine and Italian painters until the time of Michelangelo and Raphael.

CHRIST OF THE ANDES, a bronze statue of Christ on the Argentina-Chile border in the Andes, dedicated on March 13, 1904, as a symbol of perpetual peace between the two countries. It was erected jointly by Argentina and Chile on the summit (over 13,000 feet) of the Uspallata (La Cumbre) Pass, between Mendoza, Argentina, and Santiago, Chile, to commemorate the final settlement of a long and bitter boundary dispute which more than once had threatened war. Molded from old Argentine cannon, the statue is the work of the Argentine sculptor Mateo Alonzo (q.v.). The figure of Christ, 26 feet high, stands on a granite hemisphere; the left hand supports a great cross; and the right arm is raised in benediction over the two countries. The inscription in Spanish around the base may be translated: "Sooner shall these mountains crumble into dust than the people of Argentina and Chile break the peace sworn at the feet of Christ the Redeemer."

CHRISTABEL, kris'tà-běł, a poem by Samuel Taylor Coleridge. Though only a fragment, it is, among all his works, second in fame only to *The Rime of the Ancient Mariner*. The first part was written in 1797, the second in 1800; and between them and the date of its publication in 1816—a delay due largely to Coleridge's uncertain ways—Sir Walter Scott, Charles Lamb, William Wordsworth, Robert Southey, and many other people of taste and authority had become familiar admirers of the poem. Except for a certain disappointing harshness in the reviews of the day, this success was repeated in a wider public for the printed form and may be said still to hold.

Christabel for us, then, remains a fragment of a long narrative poem. The second canto leaves off with the baron's anger at his daughter's jealousy and his dispatching Tracy, the bard, to Lord Roland's castle at Tryermaine. It is a common opinion that Coleridge never told how the poem was to end. But in James Gillman's *Life* (p. 301), published in 1838, is supplied an account of Coleridge's plan for its completion in a third and fourth canto, by making the supernatural being change from Geraldine to Christabel's absent lover. Christabel is revolted, without knowing why, by the suit paid her; but she finally yields to her father's entreaties and is led to the altar. The real lover returns just in time with the ring token. The supernatural being disappears, the bell tolls, and the mother's voice is heard, and with joy the marriage and the reconciliations take place.

The metrical beauty of *Christabel* is one of its greatest claims. It is based on the principle of accent, rather than syllable counting. There are four accents to the line, with a variation in syllables as the poetic necessity and passion itself may vary. With so delicate an instrument as this, Coleridge shows himself easily to be one of the great masters of English verse.

The main idea of *Christabel* is that the virtuous people of this world may save the wicked; may have a power deeper far than the power of evil. Around this idea Coleridge weaves the story, with the framework of popular romance and legend; the pure maiden, the mother's love;

the natural-supernatural effect, to use his own phrase; the innumerable lovely cadences; the half-magical imagery; the enchantments; the poignant and lyrical beauty everywhere evident.

STARK YOUNG,
Author and Critic.

CHRISTADELPHIANS, krīs-tā-dēl'fī-āns (also called BROTHERS OF CHRIST), a small body of Christians acknowledging John Thomas (1805-1871), an English-born physician, as their founder. He emigrated to the United States in 1832, and was for a time connected with the Disciples of Christ. In 1834 he opposed the doctrines of that body concerning baptism, and in 1844 announced his belief that the existing churches were apostate; thereupon, he began to form societies which held with him to the Bible as the only rule of faith and practice and to the idea of restoration of primitive Christianity. Several years later, in 1864, the distinctive name of Christadelphians was adopted.

Christadelphians do not accept the conventional view of the Trinity, believing that the Holy Spirit is not a person, but an effluence of divine power. They believe that Christ will come and set up His kingdom in Palestine, and that at the millennium the righteous will receive the reward of eternal life and the wicked will be sentenced to eternal death. They baptize by immersion, and are conscientious objectors to war. There is no ordained ministry. In 1950 there were 115 churches in the United States, with a total membership of 3,755. *The Faith* (formerly *The Christadelphian Advocate*), published in Waterloo, Iowa, is their organ.

Consult Roberts, R., *Meaning of the Christadelphian Movement* (London 1872) and Dr. Thomas, *His Life and Work* (London 1884).

CHRISTCHURCH, kris[t]l'chūrch, parliamentary and municipal borough, England, situated in Hampshire (officially Southampton) about 25 miles west-southwest of Southampton and at the confluence of the Avon and Stour rivers, about one mile from the English Channel. It is famous for its great Augustinian priory church, dating in part from the 11th century. There are also the 12th-century Norman House and the remains of a castle of the same period. The church is over 300 feet long and contains a magnificent altarscreen. The famous south coast health resort, Bournemouth, is nearby. Pop. (1951) 20,506.

CHRISTCHURCH, city, New Zealand, capital of the Province of Canterbury, located on the east coast of South Island. The see of the primate of New Zealand, it is situated on the Avon River, seven miles from the South Pacific Ocean, and is the terminus of the Great Northern and Southern Railway. A railway tunneled through the Lyttleton Hills connects it with Lyttleton, the nearest port. It was founded by the Canterbury Association, a colonizing body of Anglican churchmen formed in 1850, and its streets were given the names of English dioceses.

It is one of the two chief centers of South Island, surrounded by the fertile Canterbury plain, an important grain and dairy region. The chief industries are tanning and meat packing. Socially it is one of the principal cities of New Zealand. Its seaside resort, New Brighton, is famous throughout the island. Christchurch con-

tains a number of handsome buildings, including a Roman Catholic and an Anglican cathedral, the government offices, Saint Michael's Church, the Supreme Court, museum, library, Canterbury University College (founded 1873), Christ's College, the McDougall Art Gallery, and a school of arts. The city celebrated its centenary in 1950 with a great pageant and games. Christchurch is the birthplace of the famous opera singer, Frances Alda. Pop. (1951) 112,681; metropolitan pop. 150,047.

CHRISTIAN, krīs'chăn; krīst'yăn, the name of 10 kings who ruled in one or more of the Scandinavian countries of Denmark, Norway, Sweden, and Iceland. The periods and nations of their reigns follow:

CHRISTIAN I, 1448-1481—Denmark, Norway, Sweden (Sweden 1457-1471); CHRISTIAN II, 1513-1523—Denmark, Norway, Sweden (Sweden 1520-1523; Denmark and Sweden separated 1523); CHRISTIAN III, 1534-1559—Denmark and Norway; CHRISTIAN IV, 1588-1648—Denmark and Norway; CHRISTIAN V, 1670-1699—Denmark and Norway; CHRISTIAN VI, 1730-1746—Denmark and Norway; CHRISTIAN VII, 1766-1808—Denmark and Norway; CHRISTIAN VIII, 1839-1848—Denmark (and Norway briefly, 1814); CHRISTIAN IX, 1863-1906—Denmark; CHRISTIAN X, 1912-1927—Denmark and Iceland (Iceland as a separate kingdom, 1918-1944).

CHRISTIAN I, king of Denmark, Norway, and Sweden: b. 1426; d. Copenhagen, Denmark, May 21, 1481. The son of Theodoric, count of Oldenburg, he was the founder of the Oldenburg dynasty of Danish kings. The Union of Kalmar, which united the kingship of Denmark, Norway, and Sweden, was practically dissolved when Christian came to the throne in 1448. He united Norway and Denmark in 1450 and seized Sweden in 1457, but his efforts to subdue Sweden ended with his defeat by Sten Sture (the elder) at Brunkeberg, near Stockholm, in 1471. He united Schleswig and Holstein with the Danish crown in 1460 and founded the University of Copenhagen in 1479. He was succeeded by his son John.

CHRISTIAN II, king of Denmark, Norway, and Sweden: b. Nyborg, Denmark, July 1, 1481; d. Kalundborg, Denmark, Jan. 25, 1559. He succeeded his father, King John, as king of Denmark and Norway in 1513. In 1515, to strengthen himself against Sten Sture (the younger), administrator of Sweden, he married Isabella, sister of Emperor Charles V. Christian incurred the hatred of the Danish nobles by enacting reforms in favor of the lower and middle classes and by allowing his Dutch mistress Dyveke and her mother to wield great influence in the administration and finances of the realm.

After several unsuccessful attempts, he asserted his claim to Sweden by arms in 1520. His wholesale massacre of Swedish nobles after his victory won him the appellation "the Cruel." In 1521, the Swedes revolted under Gustaf Vasa, whom they proclaimed king of Sweden as Gustavus I in 1523, thus ending the Union of Kalmar.

Late in 1522, the Danish nobles, resentful of the new code of laws modeled on the Dutch system, deposed Christian, drove him out of Denmark, and called his uncle Frederick to the throne. After remaining in exile for over eight years, Christian tried to recover his kingdoms and proclaimed himself king of Norway at Oslo on

Nov. 29, 1531. Hoping to negotiate with Frederick, he returned to Copenhagen. But Frederick imprisoned him, first at Sønderborg Castle, later at Kalundborg Castle, where he died.

CHRISTIAN III, king of Denmark and Norway: b. Gottorp, Denmark, Aug. 12, 1503; d. Kolding, Denmark, Jan. 1, 1559. He was chosen king in 1534, a year after the death of his father, Frederick I. An ardent Lutheran, he established the Reformation in Denmark in 1536. His attempts to reduce Norway to the status of a province were not permanently successful, but his rule did much to strengthen Denmark. He was succeeded by his son, Frederick II.

CHRISTIAN IV, king of Denmark and Norway: b. Frederiksborg, Denmark, April 12, 1577; d. Copenhagen, Feb. 28, 1648. He succeeded his father, Frederick II, as a minor in 1588. After assuming personal rule in 1596, Christian laid the foundation of the Danish Navy and developed the country's industry and commerce. In consequence of the claims advanced by Sweden to Lapland in 1611, he became engaged in the Kalmar War with Charles IX of Sweden and his successor, Gustavus Adolphus, but terminated it in 1613 by an advantageous peace, by which he gained free navigation for Denmark in the Baltic. He rebuilt Oslo in 1624 and renamed it Christiania.

Persuaded by England, France, and the Netherlands to join the Protestant cause in the Thirty Years' War, he was defeated by Johan Tserclaes, count of Tilly, general of the Catholic League, at Lutter am Barenberge in 1626. War with Sweden broke out again in 1643, in which Christian was defeated and forced to yield some of his Norwegian territory.

During his reign, Christian extended the trade of his subjects to the East Indies, introduced a judicious system of finance, and fitted out several expeditions for the discovery of a northwest passage. His court was the scene of a brilliant intellectual and artistic life. He was succeeded by his son, Frederick III.

CHRISTIAN V, king of Denmark and Norway: b. Flensburg (now in Germany), Denmark, April 15, 1646; d. Copenhagen, Aug. 25, 1699. He succeeded his father, Frederick III, in 1670. Guided by his chancellor, Count Peder Schumacher Griffenfeld, he attempted to create a new nobility from the lower orders. He waged a fruitless war with Sweden from 1675 to 1679. He was succeeded by his son, Frederick IV.

CHRISTIAN VI, king of Denmark and Norway: b. Copenhagen, Denmark, Nov. 30, 1699; d. Aug. 6, 1746. He succeeded his father, Frederick IV, in 1730. An extravagant king, he built many costly buildings, following the whims of his wife. He was succeeded by his son, Frederick V.

CHRISTIAN VII, king of Denmark and Norway: b. Copenhagen, Denmark, Jan. 29, 1749; d. Rendsburg, Denmark, March 13, 1808. He succeeded his father, Frederick V, in 1766 and, in the same year, married Caroline Matilda, sister of George III of England. He afterward traveled for three years in England, Germany, Holland, and France and became a member of several learned academies. Youthful indulgences, however, had weakened his intellect and obliged him to confide the charge of public business to his ministers, notably Count Johann Hartwig Ernst von Bernstorff and Count Johann Friedrich von Struensee, court physician. The latter, whose innovations provoked the hostility both of

the nobility and the army, was forced out of office by a conspiracy of nobles, largely because of his involvement in a scandal concerning the queen. Struensee and the queen were arrested in 1772, the queen divorced, and Struensee beheaded. The important improvements which took place during Christian's reign—the abolition of serfdom in the duchies, the inauguration of a public health program, and the promotion of trade and commerce—were the work of Count von Bernstorff. Christian became hopelessly insane and yielded control in 1784 to his son, Frederick, who ruled as regent and later became Frederick VI.

CHRISTIAN VIII, king of Denmark and of Norway for a short period: b. Copenhagen, Denmark, Sept. 18, 1786; d. there, Jan. 20, 1848. He was the nephew of Christian VII. In May 1814, while Frederick VI was ruling Denmark as regent, the Norwegians elected Prince Christian king of Norway, but, unable to hold it against Crown Prince Jean Baptiste Jules Bernadotte of Sweden, Christian was driven out of Norway in October of the same year. He became king of Denmark in 1839. The most important event of his reign was his proclamation in 1846 that Schleswig and Holstein were inseparably united to Denmark. He was succeeded by his son, Frederick VII.

CHRISTIAN IX, king of Denmark: b. Gottorp, Denmark, April 18, 1818; d. Copenhagen, Jan. 29, 1906. He was the fourth son of William, duke of Schleswig-Holstein-Sonderburg Glücksburg and succeeded Frederick VIII on Nov. 15, 1863. On the accession he immediately encountered difficulties. Frederick VIII, duke of Schleswig-Holstein-Sonderburg-Augustenburg, son of Christian Augustus, laid claim to the duchies of Schleswig and Holstein, although his father's rights had been bought out in 1852. The intervention of Prussia and Austria (1864) wrested the duchies from Denmark after a short war and Christian was compelled to renounce all his rights over them.

The remaining 40 years of Christian's reign were uneventful except for the continual turmoil of domestic politics. But if the country over which he ruled was small and comparatively unimportant, the members of his family certainly filled exalted positions. He married, in 1842, Princess Louise (1817–1898), daughter of the landgrave William of Hesse-Cassel. Of their six children, one son became king of Denmark (Frederick VIII); another, king of Greece (George I); one daughter, Dagmar, became empress of Russia as wife of Alexander III; while the other, Alexandra, as Edward VII's wife, became queen of England. A grandson, brother of Christian X, became Norway's Haakon VII.

CHRISTIAN X (CARL FREDERICK ALBERT ALEXANDER VILHELM), king of Denmark and Iceland: b. Charlottenlund Castle, near Copenhagen, Denmark, Sept. 26, 1870; d. Copenhagen, April 20, 1947. The son of Frederick VIII and Queen Louisa, and elder brother of Haakon VII of Norway, he married Alexandrine Augustine, duchess of Mecklenburg-Schwerin, on April 26, 1898, and succeeded to the throne May 14, 1912. In 1915, he granted a new constitution, which included the enfranchisement of women. During the German occupation of World War II, he chose to remain under house arrest until Denmark's liberation by British troops in 1945 and became a symbol of national resistance. In 1944, Iceland (united with Denmark in 1918

as a sovereign state under a single king bearing the title of King of Iceland and Denmark) decided by a referendum to sever all ties with the Danish crown. Six feet seven inches in stature, Christian was the tallest of European monarchs. He was succeeded by his son, Frederick IX.

CHRISTIAN I (COUNT CHRISTIAN VON BUCH), German prelate, imperial chancellor, diplomat, and soldier, one of the most picturesque figures of the Middle Ages: b. 1165; d. Tusculum, Italy, Aug. 25, 1183. He was made archbishop of Mainz in 1165. He was chiefly celebrated for his military exploits under Frederick I (Frederick Barbarossa), for whom he opened the way to Italy. After siding with the emperor against Pope Alexander III, whom he defeated in 1167, he later persuaded the emperor to make peace with Alexander and from then on protected him. He died of fever after scaring a hostile Roman army away from the walls of Tusculum, where he had gone in response to an appeal from Pope Lucius III.

Consult Verrenttrapp, C., *Erzbischof Christian I von Mainz* (Berlin 1867)

CHRISTIAN, The, a novel by Hall Caine, published in England in 1897. For the most part the scene is laid in the London of the day. The character of the title is a clergyman whose faith and resolution are broken by his love for a music-hall singer and actress.

CHRISTIAN AND MISSIONARY ALLIANCE, the title adopted when the Christian Alliance (founded in New York City in 1887 by the Canadian-born minister, Albert Benjamin Simpson) combined with the International Missionary Alliance in 1897. It is an evangelical missionary movement, stressing "the deeper Christian life and consecration to the Lord's service." There are missions in many countries, and in the United States there were 928 churches in 1953, with a total membership of 56,097. *Alliance Weekly* (New York) is its organ.

CHRISTIAN ARCHAEOLOGY, the scientific study of the material remains of early Christian times. Since it was in the Mediterranean world that Christianity originated and first spread, the investigation is primarily concerned with that region and particularly with the lands of Palestine, Asia Minor, Greece, Italy, and Egypt. Interest in the sacred sites of Palestine arose at least as early as the time of Constantine I (r. 306–337 A.D.). According to Eusebius of Caesarea, writing in the same period, the first Christian emperor ordered the demolition of a pagan temple which had been built at the place of the resurrection of Christ, and when the polluted surface soil was removed, the original tomb of the Saviour came to light. Through the beneficence of Constantine a beautiful basilica was then erected to mark the site. At about the same time, the Holy Land was visited by the emperor's mother, Helena, who dedicated a church at Bethlehem at the grotto where Jesus was born, as Eusebius also states. In 333 A.D., an anonymous pilgrim from Bordeaux, France, traveled in Palestine and mentioned both of these churches, as well as other sacred sites, in the account of his journey. Eusebius himself wrote a work *On the Names of Places in the Holy Scriptures*, giving an alphabetical list of Biblical place names, and later pilgrims

like Theodosius (about 530 A.D.) also visited many places in Palestine connected with the life of Jesus and left records of their itineraries which contain clues for the identification of sites.

In contrast with the observations of such early visitors, modern scientific work in Palestinian archaeology is usually considered to have been begun by Professor Edward Robinson of Union Theological Seminary in New York City on his journeys in the Holy Land in 1838 and 1852. Of the large number of actual excavations which have now been conducted in Palestine, the majority have to do with Old Testament rather than New Testament sites. Bethlehem, Nazareth, and Jerusalem are still densely populated towns and therefore exploration is difficult. Nevertheless not only have the earliest portions of the Church of the Nativity at Bethlehem and the Church of the Holy Sepulcher at Jerusalem been studied, but also some of the 1st century walls of Jerusalem have been traced; the pool of Bethesda (or Bethzatha) has been located near the present Church of St. Anne; and a pavement which may be that which was called Gabbatha has been found beneath a modern convent at the corner of the ancient temple area. Capernaum has been located at Tell Hüm on the Sea of Galilee and the synagogue there excavated and partially restored; the ruins are, however, probably of somewhat later date than the time of Jesus. Samaria, known in New Testament times as Sebaste (now Sebastye) in honor of the Emperor Augustus, has been excavated; so too has New Testament Jericho, winter capital of the Herods, some distance removed from the Old Testament city of the same name. Actual relics of the life of Jesus would be welcome finds, but no objects which have thus far come to light, including the famous Chalice of Antioch, supposed by some to have been the Cup of the Last Supper, have commanded the unanimous assent of experts as to authenticity.

When William M. Ramsay began his explorations in Phrygia in Asia Minor in 1880, there was no trustworthy map of that region, and so little interest did he himself have in Christian antiquities that he considered the time wasted which he spent in copying Christian inscriptions; yet ultimately his work cast a flood of light upon the travels of the Apostle Paul, and he himself became a strong believer in the trustworthiness of the Acts of the Apostles in the New Testament. The most extensive excavations in Asia Minor have been at Ephesus, where the agora, the theater, and also the Temple of Artemis, one of the Seven Wonders of the World, have been found. Work in Macedonia and Greece has been the province of classical archaeologists, yet has resulted in not a few finds of interest from the point of view of the New Testament. At Philippi a gate has been found probably to be identified with that mentioned in Acts 14:13. At Athens the Areopagus or Hill of Ares (Mars' Hill), where the Areopagus court probably met, is well known. At Corinth there is an inscription mentioning an Erastus who may be the same person as the friend of Paul named in Romans 16:23.

Discovery of the Christian catacombs at Rome came by accident in 1578; the pioneer in their investigation was Antonio Bosio, whose posthumous *Roma Sotterranea* was published in 1632. In the 19th and 20th centuries exploration was continued by the de Rossi brothers, Joseph Wilpert, Orazio Marucchi, and Paul

Styger. According to Styger's results, the oldest catacombs date from the middle of the 2d century. Adorned with paintings which utilize unobjectionable pagan motifs, Old Testament scenes, and New Testament happenings, the catacombs provide much material for an understanding of the thought world of the early Christians, and especially of their belief in salvation and the everlasting life.

A major contribution of Egypt has been the preservation in its dry sands of large quantities of ancient documents written on papyrus. These include many records and letters which reveal the character of daily life in the 1st century A.D. They are written in a kind of everyday Greek, known as *koine*, which is similar in many ways to that found in the New Testament. Among the papyri has been found a codex or book containing the church letters of the Apostle Paul which probably dates from around 200 A.D. and thus is by far the oldest manuscript of a substantial part of the New Testament which is now known.

The study of yet other subjects, including early Christian sarcophagi, churches, and mosaics, belongs to the field of Christian archaeology. As research continues, further discoveries may be made at any time, and thus the science of Christian archaeology continues to be of great interest and importance.

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JACK FINEGAN,

Professor of New Testament Literature and Interpretation, Pacific School of Religion, Berkeley, California.

CHRISTIAN CHURCH, The, a term used in a broad and comprehensive sense to include all religious bodies which worship Christ as divine or revere him as a great religious teacher and example, and wish to be called by his name. Some of these denominations assert an exclusive claim to be considered the one and only Christian church. The three main divisions are: (1) the Roman Catholic Church or Church of Rome; (2) the Eastern Orthodox churches; (3) the Protestant churches. The division of the Roman Empire into Eastern and Western empires led to a similar division of the church which, however, did not become final until the 11th century. Schisms in Western Christendom, commencing in the 12th century, culminated in the early 16th century in the Protestant Reformation, which gave birth to the Protestant churches. Of these there are numerous denominations including the Lutheran, Reformed, Presbyterian, Anglican (including Protestant Episcopal), Methodist (of Anglican origin), Baptist, Congregationalist, Friends (Quakers), Universalist, and Adventist. See also **CHRISTIANITY**; **CHURCH**.

CHRISTIAN CHURCH ARCHITECTURE has always been the architecture of its time and place as applied to the specific needs of the church. Its story began in 313 with the recognition of Christianity by Constantine I. Prior to that time the Christian congregations

had gathered for worship in the homes of their members. Probably both the house and other Roman building types suggested elements of the Early Christian Roman basilica (q.v.). In any case, one first entered the atrium, a courtyard open to the sky and surrounded by covered walks. In its center was the baptismal font on the axis of the church, where it would remain under a separate building long after the atrium had disappeared. Those who had not yet been baptized could enter only the atrium. Within the church a central aisle or nave flanked by two, or in the largest churches by four, side aisles provided ample space for the laity. A transverse member, the bema or transept, terminated the nave and provided space for the lower clergy, while beyond that on the axis of the nave a semicircular apse surrounded with seats for the higher clergy concluded the design. As the number of the clergy increased, partly because of the clerical exemption from taxation, the space reserved for them was sometimes allowed to encroach upon the nave. The altar, near the entrance to the apse, was the religious and architectural focus of the building. In the earliest churches, it was placed over the grave of the saint to whom the church was dedicated or perhaps on the site of his martyrdom, but as the countryside around Rome became unsafe, the bones of the saints were moved and reinterred below the altars. A canopy or baldachino over the altar at once emphasized its sanctity and isolated it within the church. At first the priest, celebrating Mass, stood behind the altar at the west end of the church and looked over it to the congregation, but during the 5th century this custom changed. To enable both the priest and the laity to face east, the altar was moved to the east end of the church so that the celebrant stood between the altar and the congregation. So universal was this custom of orientation that for 1,000 years or more hardly a church failed to have its entrance at the west end and its main altar at the east. The orientation, atrium, nave and aisles, transepts, and apse so well met the needs of early Christian worship that the form remained unchanged in Rome for centuries. For a further description of the basilica, see the general article, **ARCHITECTURE—Early Christian**.

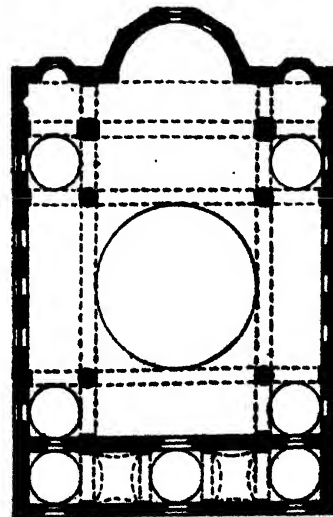


FIG. 1. Byzantine church, plan.

The customs of the church in the Byzantine Empire required separation of the altar from the laity. Hence in Byzantine architecture (q.v.), the altar was placed in an apse or chancel screened from the congregation. Such a chancel was flanked by the prothesis, where the bread and wine were prepared for the Eucharist, and by the diaconicon or vestry.

When western Europe began in the 11th and 12th centuries to recover economically and otherwise from the effects of the barbarian invasions, new forms of church architecture developed to meet new religious conditions. These were first, Romanesque architecture (q.v.), and then in the late 12th to 15th centuries Gothic architecture (q.v.). By the Romanesque period, monasticism had flowered, and such orders as the Benedictine, the Cistercian, and the Cluniac wielded great power and influence. Since the monks were often expected to celebrate the Mass daily, a single altar no longer sufficed. Moreover, the veneration of relics had grown apace, and each relic required its own altar. Hence, in addition to the high altar used for the major services, additional altars necessitated chapels (apsidioles) radiating from the apse or extended from the east walls of the transepts. An ambulatory or curved aisle surrounded the apse to give access to the apsidioles. The services were enriched with sumptuous processions that formed a substantial part of the service and that wound their way from the choir in front of the apse, enlarged to house the monks and clergy, through the ambulatory, the transepts, the aisles, perhaps also through the monastic cloisters, and back again to the choir. Thus the several parts of the great Romanesque and Gothic churches had different roles to play in the liturgy, and in fact the nave for the laity was often screened from the clergy's choir.

With the advent of Protestantism and its spread through many countries of northern Europe, a different type of church was needed. First, the congregations took a more active part in the services and therefore had to be brought closer to the minister. Second, the elaborate ceremonial, identified with popery and monasticism in the minds of Protestants, was abandoned; and third, the sermon gained in importance relative to the Eucharist. Inevitably, with the suppression of monasticism, the cloister disappeared. Multiple altars vanished with veneration of relics and without them the ambulatory lost its reason for existence. The apse and the long choir for the numerous clergy shrank to a shallow chancel or in extreme cases to none at all, so that the altar became simply the Lord's table placed almost or quite within the congregational area. The mystical aspects of the medieval church and worship had given way to the New England meeting-house.

Although there had been great preachers in the Middle Ages, such as Peter the Hermit who launched the first crusade in 1096, the complexity and forms of medieval churches were not designed primarily for sermons. With the Reformation, the sermon came to play a significant and often a dominant role in the Protestant Church, and likewise in the Roman Catholic Church during the Counter Reformation. For the sermon to be effective, the congregation must be able to see the preacher and to hear him clearly. Many of the congregation, if scattered through the long nave, the aisles, and the transepts of medieval churches,

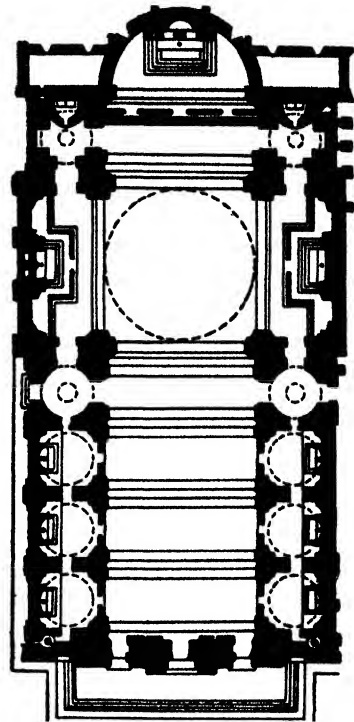


FIG. 2. Church of Catholic Counter Reformation plan. (Il Gesù, Rome.)

were disadvantageously placed for these purposes. Hence in the Jesuit churches in Rome, the nave widened, lateral chapels replaced the aisles, the transepts became shallow chapels, and the entire seating capacity came into proximity to the pulpit. So also in the Protestant churches, the wide nave, the slender colonnades, and the galleries above the aisles enabled virtually all members of the congregation to hear and see the preacher.

The Oxford movement, beginning in 1833, attempted and in large measure succeeded in revivi-

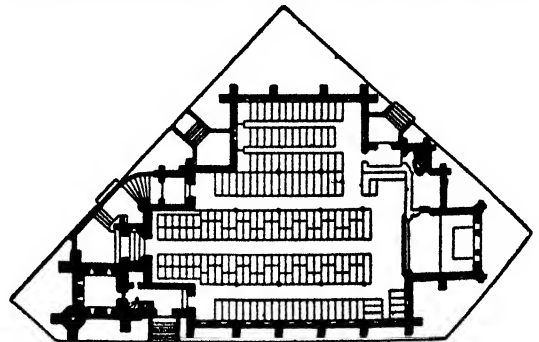


FIG. 3. Influence of Oxford Movement, plan. (St. Paul's, Buffalo, N.Y.)

ing the Church of England by a partial return to the sacramental worship and liturgy of the Middle Ages. Since that ritual had, at least in part, shaped the medieval churches, it followed that the forms of Gothic architecture would be revived also. The renewed emphasis on the Mass demanded the location of the altar in a deep, not a shallow, chancel to emphasize its sanctity, though neither the full complexities of the medieval church nor its complete liturgy could be restored.

Toward the end of the 19th century and in the 20th, still further changes in Christian church architecture have become apparent. While the medieval church played a more universal role in the lives of the people than perhaps do any of the churches of today, the latter have assumed certain specialized social functions or activities. The Sunday school, a peculiarly American innovation, the ladies' guilds or auxiliaries, and the men's clubs meeting as much for social as for religious reasons, and the business offices of the ministers or clergy and their staffs all require church or parish houses nearly if not quite as large as the church proper. In the latter, the aisles have diminished to passageways for access to the seats in a broad nave, since the sermon still plays an important part in most services. In Baptist churches the piscina, in Presbyterian churches the presbyters' chairs will ordinarily assume the place occupied by the altar in Episcopalian and Catholic churches. Thus the arrangement of Christian church architecture through the ages has faithfully reflected the changes in the liturgy and functions of the several churches, and as these functions continue to be modified, so will the buildings be adapted to them.

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EVERARD M. UPJOHN,

Professor of Fine Arts, Columbia University.

ILLUSTRATIONS: Fig. 1 from *History of World Art*, courtesy of Oxford University Press; fig. 2 also from *History of World Art*, courtesy of Oxford University Press and G. Holmes Perkins; fig. 3 from *Richard Upjohn, Architect and Churchman*, courtesy of Columbia University Press and Avery Library.

CHRISTIAN DOCTRINE, Development of. The application of the principle of development to the history of Christian doctrine is modern. Although anticipated earlier, especially by the Father of the History of Dogma, the French Jesuit Denys Petau (Dionysius Petavius, 1583-1652), the full acceptance of the theory came in the 19th century. John Henry (later Cardinal) Newman's famous book, *The Development of Christian Doctrine*, appeared in 1845. The great German histories of dogma came later—those of Adolf von Harnack, 1886-1890; Friedrich Loofs, 1889; and Reinhold Seeberg, 1895-1898. The famous French work by Joseph Tixeront appeared in 1904-1911. Inspired by these modern studies, a vast flood of literature on the subject has appeared since 1880, and the principle is now taken for granted by almost all writers on Christian doctrine. The change in point of view has paralleled the application of the same principle to historical studies generally, to literature, philosophy, art, social history, politics, and the sciences. Everyone now writes history "genetically," that is, by tracing the stages of growth from origin to later condition, and by relating the stages of growth in causal succession. It is not always possible to carry out this principle in detail; and to trace a development is not always to explain, or to assess values. Further, there are too many mysterious and unaccountable variants in human history, too many fresh emergents, due to human

genius or other causes, to make possible the demonstration of any purely mechanical course of development—as if all factors were fully known, thoroughly understood, and therefore predictable.

Despite these limitations, this modern method is far superior to the older type of presentation, in which Christian doctrine (or any particular doctrine) was pictured as a monolithic and unchanging deposit of divine truth, variously apprehended by different minds and in different generations, but essentially unaltered and unalterable. In the patristic and medieval periods, during the Reformation and Counter Reformation, throughout the age of Protestant Scholasticism, and down to the middle of the 19th century, the ancient static view prevailed. The variations seen in the presentation of various doctrines, at different times, were simply the result of changing emphasis: one age needed more emphasis upon one doctrine, or aspect of a doctrine, another upon some other; the church, exercising due "economy" (Greek for stewardship), provided from her treasure "things new and old" (Matthew 13:52), and thus achieved the proper "education of the nations" and the "discipline of souls" committed to her care.

But development goes much farther than mere emphasis. The on-going course of history has itself contributed to the development. There are certain doctrines which still remain in their pristine state, having never been challenged, debated, or defined. Others are highly complex, the result of much debate, and require careful study and expert handling for their full elucidation. Some are of primary importance (that is, the doctrines "necessary to salvation"); others are secondary and inferential (that is, as based upon the primary ones); still others are simply "pious opinions" (that is, based upon devotional considerations, bare probability, or congruence with major doctrines). For "doctrine" (Latin *doctrina*) means "teaching," in this case the teaching of the church. Back of it, underlying it, is the Christian faith; supporting and accompanying it, as its proper medium, is the Christian experience, a social phenomenon seen in common worship, common ideas, and a common terminology. Some doctrines have come in time to be authoritatively defined, as by the ecumenical councils (at Nicaea, 325 A.D.; Constantinople, 381; Ephesus, 431; Chalcedon, 451). Such authoritatively defined doctrines are technically termed dogmas and are usually associated with the creeds promulgated by the ecumenical councils. (See also **CHRISTOLOGY**; **CREEDS AND CONFESSIONS**; **INCARNATION**.) The relation of Holy Scripture to doctrine, including creeds and dogmas, is variously explained.

Protestantism, as a rule, claims to derive its doctrine wholly from the Bible; on the other hand, the Roman Catholic and the Eastern Orthodox churches and many Anglican theologians recognize the authority of ecclesiastical tradition, either as an authority parallel to the Scripture and somewhat independent of it, or as the expression of the continuous activity of study, teaching, and exposition of Scripture within the church. All Christians would probably agree that Holy Scripture is the source of Christian doctrine in one sense or the other: namely, either (1) as the inspired, authoritative record of divine revelation, the permanent medium of the revelation, and therefore the real source of Christian doctrine; or (2) as the authoritative documentation of the church's faith and teaching, that is, doctrine, in the earliest or "classical" period of its history;

accordingly, all later formulations of doctrine must be brought to the test of agreement with these "original documents of the Christian faith." Hence the church cannot "enforce any thing to be believed for necessity of Salvation" unless it is so set forth in Scripture (Thirty-nine Articles, Art. XX).

The earliest stage in the development of doctrine was the apostolic age. After the brief ministry of Jesus in Galilee and Jerusalem, and his death and resurrection, the company of his followers grew rapidly and spread over the whole Mediterranean world including the Near East. At first it was an "eschatological community" gathered together to await the "last things," namely, the return of Christ to hold the Last Judgment, the resurrection of the dead, and the inauguration of the Kingdom of God here upon earth in lieu of the present evil order. The church was simply the body of Jesus' followers who still looked upon themselves as members of the Jewish Covenant, but they gradually came to consider themselves the New Israel, or the True Israel; and as tension mounted, largely as a result of conflict or controversy over the observance of the Jewish law and belief in the Messiahship of Jesus, the Christian church and the Jewish synagogue became separated and have so remained ever since. At this early stage, the doctrines (that is, teachings) chiefly emphasized were: the Messiahship of Jesus; his imminent return; the Resurrection and the Judgment; the reality of Christ's invisible presence with the church, especially in the services of worship; the reality and significance of the "outpouring" of the Holy Spirit, which was also viewed eschatologically, as a sign of the arrival of "the latter days." These are accordingly the doctrines most strongly emphasized in the oldest parts of the New Testament.

Before long, the church came into close contact with Greek, or Hellenistic, religious thought and popular philosophy, and was forced to deal with problems and to answer questions as they arose in the new environment—questions which either had not arisen or had not been so pressing in the world of Jewish Palestine, where Christianity arose: the existence of God, His providence, His justice, His care for mankind, His purposes, the universality of sin and the problem of its removal, the reality of divine grace, the fate of the unbaptized or of the unrepentant or of the grossly wicked, the essential nature of Christ and his relation to the Father. Some of these questions—and their answers—had indeed been at least suggested in the earlier stage; many of them were destined to vex the church for centuries to come. The main problems arose from the changed environment; the religious presuppositions of the pagan world were quite different from those of the old Jewish homeland, with its self-revealed Creator God, His Law, His Covenant, His emissaries the prophets, and finally His Messiah, and the coming Judgment and Kingdom. The church found the answers to these and other questions (1) in the Old Testament, the Greek translation of which (see SEPTUAGINT) the Christian church took over from the Hellenistic or Greek-speaking Jews; (2) in the teaching of Jesus and the apostles, that is, in the church's tradition; and (3) in the living daily experience of Christians, for whom God, Christ, the Holy Spirit, and the invisible world, the grace of sacraments, answers to prayer, and the life to come were simple reali-

ties, not intellectual abstractions or theological categories. The patterns of thought, the terminology, the logical procedures required for the expression of these convictions were found ready to hand in the current philosophies of the late classical period—the fruit of centuries of intellectual toil, chiefly Stoic, Platonic, Peripatetic, and Neo-Platonic.

Out of the successive crises of the conflict with Gnosticism (2d century) and the Arian heresy (4th-5th century) emerged the massive, basically Christological system of doctrine and dogma which has been the central heritage of all Christians ever since. In the medieval period other interests engaged the church, due partly to a total change in the general outlook of European society, a different political creed (feudalism), the survival of Platonic and Neo-Platonic realism in philosophy, and finally (early in the 13th century) the arrival in the West of further logical treatises by Aristotle. Thereupon arose a whole series of new problems: the nature of the atonement; transubstantiation (the mode of Christ's real presence in the Eucharistic species); the sacraments (such considerations as their number, form, matter); the relation of reason to revelation, of faith to knowledge. The great medieval schools were the centers of debate and attempted formulation; the Schoolmen took the whole of Christian theology, that is, the thought-out, philosophically formulated expression of doctrine, as their rightful field of research and definition. With varying emphases, the formulas of the Protestant confessions (Anglican, Lutheran, and Reformed) and, on the Roman side, of the canons, decrees, and catechism of the Council of Trent gave final and authoritative expression to the whole body of medieval Christian doctrine—each, of course, with its own distinctive emphasis.

Since the 16th century, there has been no major change in the content or structure of Christian doctrine, but only a sharpening of definition on minor, sometimes warmly contested points (as in the Roman Catholic Church the definitions of the doctrines of the infallibility of the pope, the Immaculate Conception, and the Assumption of the Blessed Virgin). What chiefly characterizes the period since 1600 is the emergence of historical and literary criticism of the Bible, of church history, and of Christian doctrines, and the consequent reactions, positive or negative, to historical research and the acceptance or rejection of its results. At the present day the Neo-Orthodox movement represents an attempt to find a permanently valid body of Christian doctrine in spite of—or in the midst of—the fluctuating changes in modern historical criticism, especially of the Bible. As Modernism, about 1910, extended its influence far beyond the borders of the Roman Church, so Neo-Orthodoxy, reacting against it 40 years later, has extended its influence far beyond the borders of Protestantism.

Consult works of authors listed in opening paragraph. Most of these histories of dogma have been translated. Also consult Allen, A. V. G., *The Continuity of Christian Thought* (Boston 1884); McGiffert, A. C., *A History of Christian Thought*, 2 vols. (New York 1931); Neve, J. L., *A History of Christian Thought*, 2 vols. (Philadelphia 1946).

FREDERICK C. GRANT,
Union Theological Seminary.

CHRISTIAN ENDEAVOR, Young People's Society of. See INTERNATIONAL SOCIETY OF CHRISTIAN ENDEAVOR.

CHRISTIAN ERA, the era or epoch introduced by the birth of Christ. It was calculated in about the year 532 A.D. by a monk, Dionysius Exiguus, a resident of Syria. It is thought that he fixed the advent too late by four years, and that consequently Jesus was born, if the contradiction in terms can be permitted, in 4 B.C.—the generally accepted date among Biblical scholars. They give the "probable dates" as follows: c.4 B.C.—birth of Jesus; c.28-29 A.D.—beginning of his public work; 30 A.D.—death of Jesus. There is no historical data for determining the day of his birth; the church after much vacillation finally settled on December 25. The Christian Era is sometimes called the Dionysian period. See also *CHRONOLOGY—The Christian Era*.

CHRISTIAN FLAG, the flag sometimes displayed in churches as a symbol of Christian worship. Though recognized only by usage and not by the official sanction of any ecclesiastical body, the flag designed by Charles C. Overton in 1897 for the Brighton Chapel, Coney Island, N. Y., has been described by the Federal Council of Churches of Christ in America as "the form most generally regarded." This is "a white rectangle with a blue rectangular field in the upper corner at the mast side containing a red Latin cross." However, many churches, such as the Protestant Episcopal, employ variant designs.

CHRISTIAN KNOWLEDGE, Society for the Promotion of. The oldest and greatest of the religious associations connected with the Church of England. It was founded in 1698, although it did not receive its present name until 1701, and had for its objects: (1) to promote and encourage the erection of charity schools in England and Wales; (2) to disperse, both at home and abroad, Bibles and tracts of religion; (3) in general, to advance the honor of God and the good of mankind by promoting Christian knowledge, both at home and in other parts of the world, by the best methods that should offer. It has continued to pursue these objects, directing its efforts chiefly to Great Britain and the colonies and Commonwealth. It partakes at the same time of the nature of an educational association, a missionary society, a Bible and religious tract society, and an emigrants' spiritual aid society.

The Protestant missionaries who labored in the south of India in the 18th century were supported chiefly by this society, and it is now mainly engaged in supplying to the mission field throughout the world religious literature in the vernacular. Besides translations of the Bible and the Book of Common Prayer, it provides grammars, dictionaries, reading books, and general literature for pioneer missionaries to instruct them in the languages which they will have to use. In Scotland a similar society was organized in the year 1709.

CHRISTIAN OF SCHLESWIG-HOLSTEIN, *shlās'vīk* [*shlēs'-*] -hōl'shtīn; Angl. hōl'stīn, PRINCE (in full **FREDERICK CHRISTIAN CHARLES AUGUSTUS**), German prince: b. Augustenborg, island of Als, Denmark, Jan. 22, 1831; d. London, England, Oct. 29, 1917. He was the son of Duke Christian Augustus, who in 1848 placed himself at the head of his adherents to resist by force the claims of Denmark upon the duchies. Father and son narrowly escaped cap-

ture by the Danes at the time. The duke hurried to Berlin to beg the intervention of Prussia. Prince Christian, then 17, joined the newly constituted Schleswig-Holstein army with his elder brother, Frederick. They were defeated at the Battle of Idstedt in 1850 and Christian finally had to seek a new home. The death of Frederick VII of Denmark in 1863 reopened the Schleswig-Holstein question. But Bismarck had long kept the annexation of the duchies in mind, a policy he carried out by war in 1864. Christian went to England in 1865 and in the following year he married Princess Helena, third daughter of Queen Victoria. He was created "Royal Highness" by order of Queen Victoria, and with his wife settled down as an English country gentleman.

CHRISTIAN REFORMED CHURCH, The, a church officially established in the United States in the year 1857. Its history, however, begins in the Netherlands in 1834, when the Reverend Hendrick de Cock was deposed from the Reformed State Church of the Netherlands because of his disagreement with official interpretations of the Reformed faith. Many soon followed the lead of de Cock, among them being Dr. Albertus C. van Raalte, who led a band of pioneers to Holland, Michigan, and the Reverend Hendrik Scholte, who established his followers at Pella, Iowa. Religious intolerance in the Netherlands was the main motive for emigration, but the economic situation presented an added incentive. About two years after the arrival in America in 1847, van Raalte's group joined the Reformed Church in America (q.v.), which has existed in the United States and antecedent colonies since 1628; Scholte's group joined in 1856.

The union of the 19th century Dutch pioneers with the Reformed Church in America was an unhappy one. The long established Reformed Church seemed to the zealous newcomers deficient in doctrinal purity, neglectful of catechetical training and church discipline, and they were shocked that the sacrament of communion (the Lord's Supper) should be administered to all indiscriminately. The prevalence of these customs in Holland was the very reason why they had left the Netherlands. Secession from the Reformed Church occurred on April 8, 1857, when four congregations (about 750 families) and one pastor resigned. This small group called themselves the True Dutch Reformed Church, later changing their name to Christian Reformed Church.

Slow growth marked the progress of the infant church until around the year 1880, when two important events changed the picture. The first event was another schism within the Reformed Church of America. Contention had developed over the admittance of lodge members into the church. Many within the church refused to affiliate with lodge members and, as a result, five large and influential churches seceded and joined the Christian Reformed Church. The second event promoting growth was the heavy influx of Dutch Calvinists after 1880. Emigration from Holland accounts for the phenomenal growth amounting to 40,000 people in the years between 1880 and 1900.

The membership in 1953 totaled 173,764; the clergy, 304. They are grouped into 19 classes which meet two or three times each year. The classes

are annually represented by two ministers and two elders (lay officers) in a general synod which has authoritative jurisdiction over all the congregations. A modified presbyterial form of government functions.

As for its doctrinal commitments, the Christian Reformed Church subscribes to the Apostle's Creed, the Nicene Creed and the Athanasian Creed. In addition to these, the church embraces three Calvinistic confessional standards: the Belgic Confession of Faith (the Thirty-Seven Articles of Faith), the Heidelberg Catechism and the Canons of Dort. The Heidelberg Catechism is by far the most widely used confession of the Christian Reformed Church. Each minister must regularly and faithfully preach the "sum of Christian doctrine as comprehended in the Heidelberg Catechism." (It is divided into three sections—our sin and misery, our deliverance through Christ, and our gratitude to God.) In the Canons of Dort we have the clearest expression of the Reformed position as expressed in the five points of Calvinism. The five points of doctrine are as follows: (1) *unconditional election*; i.e., God has chosen His people from eternity, apart from any inherent goodness or work of man; (2) *limited atonement*; i.e., Christ died on the cross not to save all indiscriminately, but only those whom He elected; (3) *total depravity*; i.e., man is conceived and born in sin and is "incapable of doing any good, and neither able nor willing to return to God"; (4) *irresistible grace*; i.e., the power of Christ which seeks to draw His people to Himself is unable to be resisted by the will of man; (5) *the perseverance of the saints*; i.e., God, by His Spirit, preserves the new life given to the sinner, and brings it safely through life to its abode in heaven.

From such doctrinal commitments, it can be seen that the Christian Reformed Church is rooted firmly in the Calvinistic-Augustinian tradition, which in turn is based on the divinely inspired Word of God.

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EARL JABAAY.

CHRISTIAN SCIENCE, a religion based wholly upon the spiritual meaning of the Bible and primarily upon the words and works of Christ Jesus. It was discovered and founded by Mary Baker Eddy in 1866, following her immediate recovery from a serious accident. On the third day after the accident, she turned to her Bible for help and was instantaneously healed of the injury.

Healing, not only of sickness and sin, but of all forms of discord is regarded by those who practice this Science as among the inevitable effects of its correct application. This religion gives its adherents a new outlook on life and it is accepted by them as a completely regenerating and reforming influence in the degree that it is truly practiced. The growth of the denomination is conceded to be largely the result of healing.

Christian Science differs mainly from other religious denominations by utilizing spiritual power through prayer for the solution of prob-

lems of every nature. The application of Christian Science to health is quite generally known. Christian Scientists also hold that there are no situations for which this religion does not provide the remedy.

Christian Science teaches that God, who according to the Gospel of John is Love, is also infinite Life, Principle, Spirit, and that He is eternal good. It also teaches that because, according to the first chapter of the Book of Genesis, man is made in the image and likeness of God, man must be spiritual and not material, nor is he subject to material conditions.

The textbook of the denomination, *Science and Health with Key to the Scriptures*, was published by Mrs. Eddy in 1875. It is used in conjunction with the Bible at Sunday services in all Christian Science churches. Selections from these two books comprise the "Lesson-Sermons" read by a First and a Second Reader. There are no personal pastors in the Christian Science church. The Lesson-Sermons cover twenty-six subjects and are uniform in all churches.

The Church of Christ, Scientist, is comprised of The Mother Church, The First Church of Christ, Scientist, in Boston, Mass., and its more than 3,000 branches located throughout the civilized world. It was organized in Boston in 1879, with a membership of twenty-six. It was "designed to commemorate the words and works of our Master, which should reinstate primitive Christianity and its lost element of healing" (*Church Manual*, p. 17).

Mrs. Eddy did not at first intend to found a separate church, but in a short time it became evident that a distinct church was needed to facilitate the establishment and promotion of her religion and maintain its teaching and practice. In *Science and Health* she writes, "Until the author of this book learned the vastness of Christian Science, the fixedness of mortal illusions, and the human hatred of Truth, she cherished sanguine hopes that Christian Science would meet with immediate and universal acceptance" (p. 330).

The progress and growth of the movement while not considered phenomenal, has been steady and today there probably is not a village or town where Christian Science is not known. In accordance with the bylaws of the church, no membership figures are published. The number of its members is not considered important, but those outside the movement estimate the total as several hundred thousand.

The first church edifice was built in Oconto Wisconsin, in 1886, and is still being used for church services. In 1894 the original edifice of The Mother Church was built in Boston. Although it seats approximately 1,000 persons, it was soon found inadequate to take care of the increased attendance, and in 1906 an extension with a seating capacity of nearly 5,000 was built.

Mrs. Eddy attached great importance to periodical literature. In 1883, she founded *The Christian Science Journal*, a monthly publication which contains in addition to articles, editorials, and other literature on Christian Science, a list of branch churches and societies, a list of Christian Science practitioners and of nurses. *The Christian Science Quarterly*, containing the Lesson-Sermons for Sunday services, was established in 1890. *The Christian Science Sentinel*, a weekly, was founded in 1898; the *Herald of Christian Science* in 1903; and *The Christian*

Science Monitor in 1908. The *Herald of Christian Science* is published in seven foreign languages, German, French, Danish, Norwegian, Swedish, Dutch, and Spanish, and also in Braille.

Although most of these periodicals circulate chiefly among those who have some degree of interest in Christian Science, the *Monitor* has become world-wide in its circulation and is well known and read by a great many who are interested in factual news reporting. The *Monitor* maintains its own staff of correspondents and has branch offices in London, Paris, Geneva, and Sydney, as well as twelve branch offices in the United States.

All of the periodicals of the movement are published by The Christian Science Publishing Society, which was established by Mrs. Eddy in 1898. It occupies a block-long edifice in Boston and employs more than 1,000 persons. It is estimated that 80,000,000 pieces of literature are published annually by the Publishing Society.

From its inception, the Christian Science church has taken an interest in world affairs. The members respond generously to appeals for assistance to sufferers when emergencies arise calling for financial aid. During World War I and World War II, the Christian Science organization assisted those countries affected by the war continuously during each conflict, and after. During a period of less than forty years, commencing with 1913, The Mother Church contributed \$15,147,849.98 for relief. This amount does not include the work done individually by branch churches in their immediate vicinities.

There are no missionaries as such in the Christian Science Church. There is a board of lectureship, established by Mrs. Eddy in 1898, which is global in its activities. The members of this board, at the invitation of the branch churches, give lectures in practically every country in the world. These lectures are always free to the public and explain the fundamental teachings of the religion.

GEORGE CHANNING,

Manager, Committees on Publication, The First Church of Christ, Scientist, Boston, Massachusetts.

CHRISTIAN SOCIALISM, a type of socialism (q.v.) which results from the conflict between the existing practices and ideals of modern industrial capitalism and the Christian gospel. The Christian Socialists endeavor, as a rule, to show how the application of the gospel of Christ to economic and social conditions would solve the problems of underproduction, unemployment, poverty, waste, inadequate distribution, and the many injustices of both the old-fashioned laissez-faire economy and the more restricted modern system of free enterprise.

More specifically, the term is used for a group of British writers, lecturers, and clergymen who in the middle of the 19th century advocated the full application of the Christian gospel to social, economic, and political conditions. Chief among them were (John) Frederick Denison Maurice (1805-1872) and Charles Kingsley (1819-1875). Following the failure of Chartism (q.v.) in 1848 after a decade of effort, Kingsley launched a series of tracts and novels (*Yeast*, 1848; *Alton Locke*, 1850), and a journal was founded (*Politics for the People*, 1848). Workingmen's associations were formed, mainly educational in aim, and in 1854 a workingmen's college was estab-

lished. Cooperatives, including a cooperative wholesale society, were encouraged. In all this there is almost no trace of Marxian influence, though Karl Marx (q.v.) lived in London from 1849 to his death in 1883. The Christian Socialists were not inspired by any communistic or socialistic theory, but by fervent evangelical and liberal study of the Bible and by an earnest Christian and humanitarian concern for the poor and the underprivileged. Their influence survived long and beyond the decade following 1848. The Fabian Society (q.v.), organized in 1883, though assured of the steady improvement of social conditions in the modern world as the result of "evolution" and "progress," was likewise strongly opposed to Marxism and materialism. Though its presuppositions were sharply to be distinguished from those of the Christian Socialists (which were clerical and theological), the society nevertheless owed an immense debt to the earlier movement. Christian Socialism has never died out in the Anglican Church.

In North America the movement became prominent in the 1890's, led by such famous clergymen as Washington Gladden (1836-1918) and William Dwight Porter Bliss (1856-1926). Later movements, such as the Christian Social Fellowship, the Church Socialist League, the Church League for Social Democracy (now the Church League for Social Action), the Frontier Fellowship (a student organization), have carried on propaganda for these views. Walter Rauschenbusch (1861-1918) was a leading exponent of the movement; his *Christianity and the Social Crisis* (1907) and *Christianizing the Social Order* (1912) won a respectful hearing for the "social gospel" throughout the nation.

In Europe, Christian Socialism is usually understood in a more political sense, as a substitute for secular socialism—indeed, the movement has taken a place among the political parties of Germany, Austria, France, Italy, and other countries, sometimes under other names (such as the Christian Social Democratic Party). The Roman Catholic Church has contributed greatly to the clear statement of Christian social views. A series of important papal encyclicals (especially *Rerum Novarum*, 1891, on the condition of the workers, and *Quadragesimo Anno*, 1931, on reconstructing the social order) has dealt with the questions of work and wages, employment, family life, and the duty of employers and employees. These encyclicals have done much to encourage Christian social idealism, to discourage materialistic Marxism, and to stabilize political socialism. Despite the extravagances of Hitler's "National Socialism"—indeed quite in opposition to it—Catholic idealists have insisted upon the possibility of a genuinely Christian social order, in which Christian principles both will ameliorate the evils of unrestrained capitalism and will avoid those of materialistic socialism.

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FREDERICK C. GRANT.

CHRISTIAN UNION CHURCHES, a small body of Christians, organized in 1861,

partly in protest against the preaching of politics. Rev. James F. Given, who left the Methodist Church in 1860 because the Civil War was advocated from its pulpits, drew together those who were of his way of thinking and they organized the Christian Union, at Columbia, Ohio, in 1864. In 1938 it reported 15,400 members and 220 churches.

CHRISTIAN UNITY. The phrases "Christian Unity," "Church Unity," "Christian Reunion," "Ecumenical Movement" (the last being more common since 1927) are terms used to designate the movement to restore the broken unity of the Christian church. Although efforts have not been lacking in the past, the world-wide effort to achieve such unity (not only in the older centers of Christianity in Europe and America but also upon the foreign mission fields of Asia, Africa, and elsewhere) is a marked feature of modern Christian history, chiefly since 1910. After the breach between East and West (between Rome and Constantinople in 1054) repeated efforts were made to end the schism, chiefly on the side of Rome—as at the Councils of Lyon (1274) and Florence (1439). Similarly in the West since the Reformation the Roman Church and various Protestant groups from time to time have discussed the problem—as in the "Malines Conversations" of 1921–1925. Since the grounds of disagreement are both doctrinal and practical, the principles of both Roman Catholicism and Protestantism have proved too divergent for a simple formula of either submission or compromise to succeed.

Within Protestantism itself there have been many efforts to compose the differences between the various groups or denominations. In fairness to the leading Reformers of the 16th century it ought to be said that (except for Luther) they cherished the idea of church unity and probably never dreamed that the result of the Reform movement would be a continued process of division and subdivision. Various proposals were entertained or offered by official bodies in the 16th and 17th centuries for the settlement of controverted issues and for the establishment of one type of orthodox doctrine and of organization, at least within each single nation (on the principle of *cuius regio, eius religio*: "whose is the territory, his is the religion"—the prince's faith determines that of his subjects). As a result, each nation with an established Protestant state church was confronted with groups of dissenters, who in time either won their liberties or were suppressed or were expelled, with the further consequence of the rise of still more separatist sects.

Since the 17th century, and especially since the end of the 18th, a wholly new outlook has come to characterize Western Christendom. The bitter theological controversies of the early days of Protestantism have been forgotten; an intensely practical emphasis has taken place in Western society as a whole—the immense missionary expansion of the Christian religion since 1800; and the closer contacts with other churches (including the Orthodox Eastern and the Roman Catholic)—these and other factors have brought home to modern Protestants the seriousness of their unhappy divisions and have made it clear that if the church is ever to achieve its world-mission it must be united. The voice of the church on public issues must not remain a con-

fused babel of separate voices; the overlapping and duplication of efforts, especially in the mission field, must stop; competition must yield to cooperation both in the churches at home and in the world at large. At the same time the conviction has deepened among the leaders of the churches that the theoretical objections to disunity are as real as the practical: it is contrary to the very first principles of the Christian religion that the church should be divided; the New Testament insists upon a religion with "one Lord, one faith, one baptism, one God and Father of us all" (Ephraim 4:5); in a multiplicity of churches not all can be the "true" church, though each may hold one or more aspects or qualities of the true church. Hence there has developed in modern Protestantism the conception of a genuinely attainable unity in diversity—to be achieved not through uniformity but through an inner unity of the spirit (Ephraim 4:3), which will command the loyalty of all: "in essentials unity; in nonessentials liberty; in all things charity." In a sense the church has never been wholly united, not since the apostolic age; in another sense the unity of the church has never been broken, for the spiritual unity of Christians in Christ has remained real through all historical vicissitudes. These principles are of major importance in the modern approach to Christian Unity, which aims to include all genuine expressions of Christian faith and practice rather than to exclude all except those which conform to a certain type, though there is no wish to limit unity to the "greatest common denominator" of beliefs.

The modern movement toward reunion began late in the 19th century, The Chicago-Lambeth Quadrilateral of 1886 proposed as a minimum basis of agreement the Holy Scriptures, the Nicene Creed, baptism and the Lord's Supper, and the historic episcopate. This led in 1910 to the Protestant Episcopal Church's proposal of a world conference on matters of faith and order; the ensuing ecumenical conferences (from that at Edinburgh in 1910 to that at Amsterdam in 1948, when the World Council of Churches was organized) mark the successive steps toward the goal. At the latter conference the Orthodox East was represented but not the Roman Catholics, except by unofficial observers. The leading spirit in the earlier negotiations was Bishop Charles Henry Brent (q.v.). After Brent's death in 1929, William Temple, archbishop of Canterbury, assumed the leadership, and, although he died in 1944, his spirit and thought were enormously influential in preparing men's minds for the action taken at Amsterdam four years later.

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FREDERICK C. GRANT,
Professor of New Testament, Union Theological
Seminary.

CHRISTIAN YEAR, The. *The Christian Year*, by the Rev. John Keble, is a series of metrical compositions or thoughts in verse for the Sundays and holy days throughout the year. The work was intended to be an aid to the reader of the Book of Common Prayer of the Established Church of England; its object, in the words of the author, "will be attained if any person find assistance from it in bringing his own thoughts and feelings into more entire unison with those recommended and exemplified in the Prayer Book." It has, also, an historical significance, inasmuch as it expresses in poetry the spirit which inspired the Oxford Movement (q.v.). Although it does not contain the best of Keble's poetry, it is the work by which he is most widely known, and by which, in all likelihood, he will be chiefly remembered. When published in 1827, its success was immediate. It was, and doubtless remains, one of the most successful series of religious poems ever published, and before the end of 1867, the work had run into 109 editions—the editions in each case varying from 3,000 to 600 copies.

It is not difficult to account for the success of *The Christian Year*. The different poems expand, elaborate, and illuminate some of the most familiar and most cherished Scriptural scenes, events, and texts. It is doubtless true that most people are not "athletic readers"; that most do not think strenuously, or use their imagination effectively, while they are reading. A substitute, or aid, such as Keble supplies, usually does not fail to attract attention and gain wide acceptance. There is, also, in *The Christian Year* certainly enough of true poetic quality to sustain the whole.

CHRISTIANA, the wife of Christian in John Bunyan's *Pilgrim's Progress* (q.v.). She makes her appearance in the second part of the allegory. Moved by a vision, Christiana sets out with her children on the same pilgrimage as her husband, fleeing from the City of Destruction. Her neighbor Mercy accompanies the family, despite the objections of Mrs. Timorous and others. They are escorted by Mr. Greatheart, who overcomes Giant Despair and other monsters, eventually bringing them safely to the Celestial City.

CHRISTIANA, kris-ti-ā'n-ā, town, Delaware, in New Castle County, on Christina Creek, an affluent of Christina River, 4 miles west of New Castle. The village was named in honor of Queen Christina of Sweden (r. 1632-1654), the daughter of Gustavus Adolphus. Like the stream flowing through it, the village was originally called Christina, but in colonial times the name for both became corrupted to Christiana. By an act of the legislature in 1936, the older spelling was restored for the creek but not for the village; however, locally the village name has always been pronounced Christeen. As early as 1686 a bridge spanned the Christina at this point. Many famous travelers stopped at Christiana Bridge. In 1765, Charles Mason and Jeremiah Dixon met here to discuss boundaries with the commissioners of Pennsylvania and Maryland. Colonial shipping often ascended from the Delaware River to load produce, grain, and high-grade flour milled on the banks of the Christina and neighboring streams. Christiana in the mid-18th century with its 70 or 80 houses and two inns, the Christina and the Shannon, had a com-

mercial importance which disappeared a century later with changes in transportation routes. Among the several old colonial structures the most notable is the privately owned Lewden House, built in 1770 and enlarged in 1815. Pop. (1950) 500.

CHRISTIANA, kris-tyā'n-ā, kris-chē-ā'n-ā, town, Jamaica, British West Indies, is situated in the west-central part of the island nine miles north of Mandeville, at an altitude of approximately 2,500 feet. It is the center of an agricultural region in which bananas, ginger, coffee, and pimentos are raised. Pop. (1943) 2,825.

CHRISTIANA, kris-ti-ā'n-ā, town, Union of South Africa, is located on the Vaal River in the southwestern part of the Transvaal, 65 miles north-northeast of Kimberley. The town, at an altitude of 3,968 feet, is the seat of a magistracy. Since 1870 it has been an important center for alluvial diamond diggings. There is excellent fishing in the Vaal at this point, and the surrounding district is noted for its fine flavored grapes and other fruit. A considerable amount of land is under irrigation. White pop. (1950) 2,436; all races, 4,609.

CHRISTIANA RIOT. On Sept. 11, 1851, Edward Gorsuch of Maryland, his son, Dickinson Gorsuch, a party of friends and United States Deputy Marshal Henry H. Kline, having secured a warrant from Philadelphia, came to Christiana, Lancaster County, Pa., to arrest a fugitive slave who formerly belonged to Gorsuch and who had fled northward by means of the underground railroad. They approached the house where the fugitive had taken refuge, fired two shots, and demanded the possession of the slave. The neighborhood was aroused, and several armed Negroes appeared on the scene, as also did Casper Hanway and Elijah Lewis, Quakers, who tried to persuade both parties to disperse. The deputy marshal ordered them to join his posse, but they urged him to withdraw for his own sake. In the exchange of rifle fire which followed, Gorsuch was killed, his son seriously wounded, and the rest fled without capturing the slave. On Nov. 24, 1851, 38 Negroes and Quakers were tried for treason by John W. Ashmead, United States district attorney, before Justice Robert Cooper Grier of the United States Supreme Court at Independence Hall in Philadelphia. Among the counsel for the defense were Thaddeus Stevens, Theodore A. Cuyler, and John Meredith Read, who presented the chief argument. Opinion was so strongly for the prisoners that the jury acquitted them without leaving the box.

CHRISTIANCY, Isaac Peckham, American editor, jurist, and public official: b. Johnstown, N. Y., Mar. 12, 1812; d. Lansing, Mich., Sept. 8, 1890. Descendant of Dutch forebears named Christiaan who emigrated from Leiden to New Netherland in 1614, Isaac passed his childhood on his father's farm near Johnstown, Fulton County, N. Y. Though he had very little formal education he began teaching school at the age of 18. In 1834 he began studying law at Ovid, N. Y., and two years later moved to Monroe, Mich., where he became clerk in the United States land office. Admitted to the bar in 1838, he served three terms as prosecuting attorney of Monroe County (1841-1846). Al-

though a staunch Democrat, the slavery issue impelled him to change his allegiance; he joined the Free-Soil Party and attended its convention at Buffalo in 1848. A member of the Michigan Senate from 1850 to 1852, in the latter year he ran for governor but was overwhelmingly defeated. When the Free-Soil and Whig parties merged in 1854 to form the Republican Party, Christianity became a Republican. He summoned the new party's convention at Jackson, Mich., in 1854 and was a delegate to the first national convention at Philadelphia in 1856. In the latter year, having acquired the *Monroe Commercial*, as its editor he vigorously supported the Republican cause. In 1858, he became one of the first four justices of Michigan's supreme court. Regularly re-elected, he resigned the justiceship in 1874 to go to Washington as senator. Resigning his senatorial seat in 1879, he was appointed minister to Peru by President Hayes. He returned to the United States in 1881 and retired to private life.

CHRISTIANITY. Christianity is the most widespread and the most influential of the religions of mankind. It has as its central and determinative figure Jesus Christ. In these two facts are some of the most provocative questions in human history.

The Unpromising Beginning.—At first sight, Jesus, to whom the designation Christ, or (the Lord's) Anointed, is usually affixed, with the inference that he was the Messiah expected by the Jews, seems most unpromising for the role which has been his. He was of humble birth and was reared in an obscure village. His public career was brief. It appears at most to have been only three years and it may have been much less. He wrote no book nor does he seem to have given much thought toward putting his teaching into organized form. So far as our records show, he appears to have given little attention to creating a continuing organization. He had an exalted conception of his mission and believed that in him God was beginning a new and supremely important stage in man's course, but it is at least doubtful whether he thought of himself as founding a new religion. His intimate friends were drawn largely from what we would call the lower middle class. At a crucial moment one of them betrayed him; another, their chief spokesman, denied him; and the others were bewildered and disheartened. The leaders of his own people accused him of blasphemy and on the charge that he intended to lead a revolt turned him over to a Roman procurator who, somewhat contemptuously, had him crucified between two malefactors. His disciples, profoundly convinced that God had raised him from the dead, formed the nucleus of the Christian church.

Initial Convictions.—The convictions which gripped the first Christians were sweeping and compelling. The term Christianity, in its Greek or Aramaic equivalent, does not appear in the earliest records. The characteristic word, especially on the lips of Jesus, we translate as Gospel. "Good News." As the first Christians saw it, the Good News is that in Jesus, God was inaugurating a new era, His kingdom or rule, in a fresh way. To enter or even to see that kingdom involved such a basic reorientation that it could best be described as a complete change of outlook and purpose, a new birth, becoming once more a little child. The new birth is made possible by God through His Holy Spirit. It is an

introduction to an endless life marked by a whole-hearted response in faith to God, to God who is self-giving love and who through His grace—grace which springs from His Love and which men because of their sin against Him do not deserve—sent His only Son who became flesh in Jesus in order that all who believe in him might be "sons of God, joint-heirs with Jesus Christ" and "should not perish but have everlasting life." That life has as its essential characteristics the knowledge and love of God and "the fruits of the Spirit," that is, "love, joy, peace, long-suffering, gentleness, goodness, faith, meekness, self-control."

Those who have entered upon this life, as the early Christians conceived it, constitute a new community, the church, of which Christ is the head, and which is to be without distinction of sex and is to be drawn from all nations, races, and cultures. The early Christians felt themselves under the compulsion of a commission from Jesus to bring into discipleship all nations, baptizing them, and teaching them to observe all that he had commanded of his first disciples.

Christianity Wins the Roman Empire and Spreads Beyond It.—Yet at the outset Christians appeared to be only one of several Jewish sects, a small minority, with internal divisions, some of them bitter, and without the slightest prospect of great growth or long continuing existence. Moreover, the high demands that Jesus made on those who would follow him seemed to preclude an extensive constituency.

Within five centuries, however, and in spite of the earlier hostility of the state and of much of the populace which broke out in chronic and at times unusually virulent persecution, Christianity won its way, was officially espoused by that state, the Roman Empire, and became the professed faith of the largest group of civilized mankind, the Graeco-Roman world. In doing so it displaced a host of rivals, some of them apparently well-established. In the course of the succeeding 14½ centuries, Christianity was propagated through migrations and missionaries until it had followers among all but a few tribes and peoples. The most widely used chronology dates history B.C. or A.D., before Christ and in the year of the Lord, thus declaring the advent of Christ to be the most significant event in the course of mankind on the planet.

To examine the significance of this record would lead us far beyond the limits of this article and would take us into issues which have long engaged some of the ablest minds and noblest spirits of the human race. Such basic questions are involved as the nature of the universe and of man, the relation of the one to the other, and possible patterns and meaning in history. Here we can only sketch in the most summary fashion the major movements in Christianity which have given it the features that have characterized it across the years and in its 20th century.

It was during its spread through the Roman Empire that Christianity developed the main outlines of the theology, the sacred body of writings, the organizational structure, and the forms of worship and discipline which have been perpetuated in the churches to which the majority of those who bear the Christian name have since belonged.

Early Christian Theology.—From the very beginning the creative impulse which Christianity has shown stimulated first-class minds to wrestle in an original fashion with the intellectual prob-

isms which it presents. Among those who early stood out were Paul of Tarsus (Saint Paul), Tertullian of Carthage, Origen of Alexandria, and Augustine of Hippo (Saint Augustine).

A major contribution of Paul was his successful assertion that to become a Christian it was not necessary to be incorporated into Judaism and that to make Christianity a Jewish sect was to miss the essence of the Gospel. Paul and others like him soon constituted the majority, and those Christians who attempted to keep within the confines of Judaism became a dwindling minority.

The problems which chiefly engaged leading Christian thinkers were God, the nature and nature of man, and the relation of God and man. Christians believed God to be one, but they were concerned to discern how He could be one and to make room in their conception of Him for what were to them facts of experience and history. The favorite name by which Jesus addressed God was Father. This name also was found in Judaism, from which Christianity sprang. Christians felt themselves constrained to regard Jesus as, in a unique way, the Son of God. They knew in themselves a dynamic quality which they called the Spirit, or the Holy Spirit. Very early, therefore, they were thinking of God as one and also as the Trinity, namely, Father, Son, and Holy Spirit. How could this be, what are the characteristics of each of these three, and how are the three related to one another?

The debates on these questions were prolonged and often marked by reciprocal denunciations. In the 2d century they centered about the Gnostics (see Gnosticism) and the Marcionites (see Marcion). Both Gnostics and Marcionites regarded matter, including flesh, as evil, and pure spirit as good, and believed salvation to be the emancipation of human souls from the contamination of matter and their translation into the realm of spirit. They tended to deny that Christ had come in the flesh.

It was in part to meet this threat that what became the majority, and which called itself the Catholic Church, developed tests in order to preserve the faith which Christ had given to his intimates and which these intimates, the apostles, namely those sent out under his commission, had taught. These tests were (1) what is usually called the Apostles' Creed, an elaboration of an early baptismal formula; (2) the New Testament, made up of books attributed either to the apostles or to those instructed by them; and (3) bishops in an unbroken succession from those believed to have been appointed by the apostles.

The major debate in the 4th century was over the issue of whether the Son had been created by the Father rather than "begotten" by Him, and whether he was of "similar" but not of "the same substance" with the Father. Those who held that the Son had been created, that there was a time when he was not, and that he was of "similar substance" were known as Arians. Their views were ultimately rejected by the Catholic Church. (See Arianism.)

A major stage in that rejection was what is known as the First Ecumenical Council, which convened at Nicaea, in Asia, not far from Constantinople, in 325, at the invitation of Constantine, the first Roman emperor to align himself with the church. Constituting a precedent for gatherings designed to act for the entire church, the Council of Nicaea expressed its mind in a

brief document which, with later modifications, is known as the Nicene Creed and continues in use in the churches—Orthodox, Roman Catholic, and Protestant—in which are included the majority of those who bear the Christian name. Churches holding Arian views continued for several centuries but eventually died out. (See also Nicaea, or Nice, The Councils of.)

In further debates over the relation of the divine and human in Jesus Christ, the decision to which the churches that contain most Christians still adhere, was reached in 451, at the Fourth Ecumenical Council, which met at Chalcedon at the call of Marcianus, the Eastern Roman emperor. It held that "our Lord Jesus Christ (is) at once complete in Godhead and complete in manhood, truly God and truly man." Those who differed, stressing the deity of Christ and minimizing his humanity, were known as Monophysites (q.v.). In one or another form their views are still cherished by the Armenian Church, the Jacobite Christians (with headquarters in Syria), the Copts (the majority church in Egypt), and the Abyssinian (or Ethiopian) Church (q.v.).

The nature of man and the manner in which the saving grace of God operates on it were also debated. Especially notable were the convictions of Augustine (354–430), in his later years Bishop of Hippo in North Africa. His own remarkable spiritual pilgrimage and conversion, narrated in his *Confessions*, helped to confirm him in the belief that men at their birth are tainted with original sin which is a legacy from the willful transgression of the first man, Adam. That taint is such that men of their own will cannot obey God's commands or accept His grace in Christ. God, so Augustine said, has predestined or elected those who will accept His grace and thus enter upon eternal life. For those so chosen, Augustine went on to declare, God's grace is irresistible, and, once saved through that grace, they will persevere and enter into eternal blessedness with Him. In contrast, Pelagius (360?–420), a British monk resident in Rome, rejected original sin and insisted that men have free will and can conform to God's commands. For some years the controversy raged, but a century after the death of Augustine the Western portion of the Catholic Church formally adopted his position, although in a modified form. In this, and in other aspects of theology, Augustine profoundly and permanently influenced the Christianity of the West, both Catholic and Protestant.

The Organization of the Church.—Arising as it did within the Roman Empire, the church in part reflected the organizational pattern of that realm. Early there arose a distinction between clergy and laity. The main ranks in the clerical hierarchy were deacons, priests (presbyters or elders), and bishops. The ordination of deacons and priests was by a bishop. To be valid, so it was held, it had to be by a bishop who was in unbroken succession from the original apostles. After a marked variety at the beginning, the practice soon developed of having only one bishop in a town or city. The area over which the bishop had jurisdiction was eventually known as his diocese, a term found in Roman civil administration. Bishops in the larger cities naturally tended to overshadow those in the smaller ones. Those in the major ones, Jerusalem (because it was where the church was born), Rome, Antioch, Alexandria, and Constantinople, came to be

known as patriarchs. The Bishop of Rome, to whom the title of pope was later exclusively given, claimed priority and authority over the entire church. The position of Rome as the capital of the empire and the belief that Peter and Paul had been martyred there aided this claim, but the popes rested their authority primarily on the conviction that Peter was the first bishop of Rome, that upon him Christ had founded the church, that to him Christ had given the keys of the kingdom of heaven, and that they, as the successors of Peter, had inherited his powers.

The political unity of the Roman Empire facilitated the realization of the dream of the oneness of the church which was inherent in Christianity, but, as we have suggested, even a visible, structural unity was never fully achieved, and within the Catholic Church itself there were never lacking failures to achieve the unity of love which is of the essence of the Christian faith.

Sacraments and Worship.—The church early developed what were called sacraments. The original ones were baptism and the Eucharist. Admission to the church was through baptism. For converts it was preceded by a catechumenate, a period of instruction. It was taught that baptism washed away the taint of original sin. The Eucharist, or the Lord's Supper, believed to have been instituted by Christ on the night before his crucifixion, was central in Christian worship. Christ was held to be present in it in a special way. Around it elaborate liturgies developed. To be valid it had to be administered by either a priest or a bishop.

There were additional forms of worship on every day of the week. The first day, Sunday, the Lord's Day, made memorable by the Resurrection of Christ, was observed by rest and worship. There were special days, notably Easter, commemorating the Resurrection. The season which immediately preceded it came to be known as Lent. The observance of the birth of Christ and of other events connected with his life and with that of the church were gradually brought into the calendar. Martyrs and those deemed ideal Christians were revered as saints and their intercession with God was asked. The Virgin Mary was especially honored as "the Mother of God."

Discipline.—One of the features of the life of the church was the effort to bring and hold its members to the high standards set by Christ. It was long held that there was no forgiveness for grave sins committed after baptism, among them murder, adultery, and apostasy. As time passed and the numbers of Christians increased, the Catholic Church made provision for the forgiveness of sins, even of the most grievous. But this was to be only after confession—in the early centuries a public confession before the entire congregation—and after a period of discipline and penance during which the offender was not admitted to the Eucharist. Some groups, among them the Novatians (see *NOVATIANISM*) and the Donatists (q.v.) left the Catholic Church in protest against what they deemed laxity in the treatment of sinners.

Monasticism.—As the numbers of Christians mounted and the general level of morality in the church fell, monasticism (q.v.) arose, in part as a protest and in part as an effort to attain fully to the demands of Christ. Monasticism first became widespread in Egypt in the early part of the 4th century, but it quickly spread or sprang

up independently in other areas. Some monks dwelt alone, as anchorites, and others lived in communities under a common rule and organization. The monastic way of life was adopted by both men and women, but by more of the former than the latter. It entailed poverty, asceticism, and an exacting routine of worship. Various rules were formulated for monastic communities. Famous among the early monastic communities were those of the notable theologian and bishop, Basil of Caesarea in Cappadocia, in the 4th century, and Benedict of Nursia, at Monte Cassino in Italy, in the first half of the 6th century. Both rules spread widely, the former chiefly in the East and the latter in the West.

By the end of the 5th century the overwhelming majority of the population of the Roman Empire bore the Christian name. While Christianity had spread beyond the borders of that realm, notably eastward into Mesopotamia and the Persian Empire and to India, it had become almost identified with the Roman Empire and Graeco-Roman civilization.

The Great Recession, c.500 A.D.—c.950 A.D.—With the decline of the Roman Empire came a series of blows which threatened the very existence of Christianity. The decline of Rome is usually dated as beginning late in the 4th and early in the 5th centuries. It arose partly from internal weakness, weakness of which Christianity was neither the cause nor the cure. It was signalized and to a large degree brought about by invasions, some by barbarians from the north and some by Arabs from the southeast. The latter were champions of a new religion, Islam, which came to birth through Mohammed in the 7th century. The northern invaders were either pagans or Arian Christians, but in time most of them were won to the Catholic faith. The Moslem Arabs overran about half of what had been embraced in the Roman Empire and with it approximately half of what might be called Christendom. In the Arab-ruled lands the churches dwindled and in some areas on the north shore of Africa completely disappeared. Only in Sicily and what are now Spain and Portugal did Christianity ever regain the territory won by Islam.

Moreover, as the Roman Empire waned, the Catholic Church, deprived of the support given by its embracing structure, drifted apart into regional fragments. The two chief of these centered around Rome in the West and Constantinople in the East, the nuclei respectively of the Roman Catholic Church and the Orthodox churches. While in the 7th century Christianity had spread as far eastward as the China Sea, by the middle of the 10th century it had lost so much ground and had suffered so greatly in inner morale that it was not at all clear whether it would survive.

A Forward Surge, c.950 A.D.—c.1350 A.D.—From about the middle of the 10th century to about the middle of the 14th century, Christianity had a forward surge which carried it over a wider area than at any earlier time, and it left a deeper impress upon segments of mankind, mainly in western Europe, than it had in the heyday of its influence in the Roman Empire. Between the 9th century and the 14th century Christianity won the professed allegiance of most of such peoples in Europe as had not earlier adhered to it. These peoples included Scandinavians, the Poles, the Czechs, the Magyars, the Bulgars, and many of the Russians. Scandinavians carried the faith to

Greenland and possibly to North America. Christian minorities arose across Asia, chiefly through the Nestorians (see NESTORIANISM) who were the major church in Mesopotamia, Persia, and India, and through Roman Catholics from western Europe. In western Europe many new monastic orders sprang up, evidence of earnest commitment to the Christian faith. Prominent among them were the Cluniacs, the Cistercians, the Franciscans, and the Dominicans (qq.v.). Western Europe also was the scene of marked theological ferment. Among the outstanding theologians were Saint Anselm, Peter Abelard, and, towering over them all, Saint Thomas Aquinas. The papacy increased in power and was potent in most aspects of the life of Europe. The vitality inherent in Christianity also found expression in movements which the Catholic Church denounced as heretical. Prominent among them were the Cathari and Waldenses (q.v.) in the West and the Bogomils and Paulicians (qq.v.) in the East. Every phase of the culture of western Europe was in part molded by Christianity. This was true in religion, politics, education, literature, scholarship, business ideals, ethical standards, and social customs and institutions.

A Second Recession, c.1350 A.D.-c.1500 A.D.—From approximately the middle of the 14th century to the beginning of the 16th century there was another recession in the Christian tide. However, it was neither so prolonged nor so severe as that which followed the 5th century. Through the dying out of the Scandinavian settlers, Christianity disappeared from Greenland. The minorities which represented Christianity in central and eastern Asia also vanished. The conquests of the Ottoman Turks brought a fresh advance of Islam which made it dominant in Asia Minor, Constantinople, and much of the eastern Mediterranean region. In western Europe, the chief remaining stronghold of Christianity, the Renaissance, a prolonged division between rival lines of popes, and widespread corruption among the clergy both high and low brought a decline in the morale of the church.

Yet there was much evidence of vitality, partly in new monastic movements and in a rise in the devotional life which gave birth to such classics as *The Imitation of Christ* and *The German Theology*, and partly in movements, notably the Lollards (q.v.), begun by John Wycliffe in England, and the followers of John Huss (or Hus) in Bohemia, which were regarded as heretical by the Catholic Church. In the Russian Orthodox Church there was vigorous life which showed itself especially in monasticism. One trend in Russian monasticism, that of the nonpossessors, was toward complete poverty together with retreat from all self-assertion.

Renewal and Advance, c.1500 A.D.-c.1750 A.D.—Beginning late in the 15th century and mounting in the 16th and 17th centuries, there came the greatest awakenings which Christianity had thus far experienced. These had several expressions. One was the Protestant Reformation, which began in 1517 at Wittenberg in Germany under the leadership of Martin Luther, Augustinian monk and university professor. Its distinctive tenets were salvation by faith and the priesthood of all believers.

Protestantism took four major forms: (1) Lutheranism became the prevailing religion in northern Germany and Scandinavia with smaller

groups in the Netherlands, Hungary, and Transylvania. (2) The Reformed and Presbyterian churches had as their chief figure John Calvin, whose *Institutes of the Christian Religion* (1536) became a standard statement of Protestant theology. The Reformed churches were prominent in Switzerland, France, southern Germany, the Netherlands, and Scotland, and were also found in some other countries. (3) The Church of England broke with Rome. It preserved many of the features inherited from its Catholic past and was also influenced by Protestantism. (4) The Anabaptists, on the extreme fringe of Protestantism, and mostly persecuted minorities, displayed great variety.

Reform swept across the Roman Catholic Church, renewed its zeal, and purified its morals. Beginning in Spain before Luther, it soon became in part a reaction against Protestantism. Out of the Counter Reformation arose new monastic orders, the stiffening of the discipline in old orders, and the Society of Jesus, founded by Saint Ignatius of Loyola. The Council of Trent, meeting intermittently from 1545 to 1563, enacted legislation which furthered reform in the Roman Catholic Church and also defined the beliefs of that church as against Protestants. Conflicts between Protestants and Roman Catholics contributed to a number of wars, notably the Thirty Years' War, 1618-1648, fought mainly in Germany. (See COUNTER REFORMATION; JESUITS; TRENT, COUNCIL OF.)

In the 17th century Russia saw secessions from the official Orthodox Church, the Old Believers, partly a protest of the humbler classes against what they deemed heretical innovations forced on them by the bishops.

Beginning late in the 15th century, Christianity had the greatest geographic expansion which it or any other religion had thus far displayed. It was largely, although not entirely, connected with the explorations, conquests, and migrations of Europeans, chiefly those of the Spaniards and Portuguese, but also those of the French, the Dutch, and the English. By this expansion Christianity was planted through much of the Western Hemisphere, along the coastal fringes of Africa, and in some of the islands which bordered southern and eastern Asia, and was strengthened in India and reintroduced into China. The expansion was mostly by Roman Catholics, but across the northern reaches of Asia it was by the Russian Orthodox, and in the English and Dutch possessions, notably in the 13 colonies which were soon to become the United States, it was by Protestants.

Pause, c.1750 A.D.-1815 A.D.—In the latter part of the 18th century there came a pause in the Christian tide. The rationalism and skepticism of the Enlightenment, the French Revolution and wars which engulfed Christendom, and the papal suspension of the Society of Jesus threatened a major recession. Before it gained headway, however, there was another forward pulsation.

The Great Century, 1815-1914.—The century between the end of the Napoleonic Wars in 1815 and the outbreak of World War I in 1914 was marked by quite contradictory currents. On the one hand, several forces worked against Christianity and seemed to presage its demise. Among them were a continuation of the 18th century rationalism, fresh scientific discoveries, the Darwinian theory of evolution, new ideologies

including especially communism, a trend toward secularism, and strong anticlerical movements in Roman Catholic lands. On the other hand there was a fresh burst of life in Christianity. This was seen in the Orthodox churches, especially that of Russia, still more in the Roman Catholic Church, and most impressively in Protestantism. The revivals in Protestantism were particularly marked in the two lands which had the greatest growth in wealth and power in the 19th century, Great Britain and the United States.

The surge of vitality found expression in a number of ways. Among them were new congregations and monastic orders in the Roman Catholic Church, the erection of thousands of church structures, the expansion of the Sunday school movement which had begun late in the 18th century, the rise of the Young Men's Christian Association and the Young Women's Christian Association (qq.v.), additional Protestant denominations, the remarkable growth of several existing Protestant denominations, and the further geographical expansion of the faith. That expansion was brought about partly by migrations of Christians to new areas, mainly in the United States, Canada, Australia, New Zealand, South America, and South Africa, and partly by missions among non-European peoples. For the first time Christianity had become worldwide.

The Latest Age.—The period to which World War I was an introduction brought added threats to Christianity. By some observers it was declared to have ushered in the post-Christian era. Over and beyond the continuation of the adverse forces of the 19th century, world wars ravaged the traditional Christendom and revolutions swept across it, some of them, engineered by fascism and national socialism, in effect anti-Christian, and the major one, that which put communism in the saddle, frankly so.

In Europe, the heart of Christendom, the numbers of practicing Christians declined. Yet, by a seeming paradox more pronounced than that of the 19th century, Christianity registered striking gains. These were partly in the mounting proportion of church members in the population of the United States and partly in increases in the Christian minorities in most non-Occidental lands, notably Africa south of the equator, India, Indonesia, until 1940 in Indochina, until 1950 in China, and, with a pause in the late 1930's and the early 1940's, in Japan. The gains were also seen in vigorous theological currents in the Roman Catholic Church and especially in Protestantism, in the deeper rootage of Christianity among non-Western peoples in trained and devoted leadership, in the fashion in which Protestants were moving to a growing unity among themselves which also drew in some non-Protestants, and in wide-reaching and multiform effects on mankind.

See also BIBLE; CATHOLIC CHURCH, ROMAN; CHRISTIAN DOCTRINE, DEVELOPMENT OF; ESCHATOLOGY; EXEGESIS, BIBLICAL; GOD; GRACE OF GOD; JESUS CHRIST; MONASTICISM; NEW TESTAMENT PROBLEMS; NEW TESTAMENT THEOLOGY; PROTESTANTISM; REFORMATION, THE; RELIGION; SACRAMENTS.

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KENNETH SCOTT LATOURETTE,
Sterling Professor of Missions and Oriental History, Emeritus, in Yale University.

CHRISTIANSAND. See KRISTIANSAND.

CHRISTIANSBURG, krís'chänz-bürg, town, Virginia, seat of Montgomery County, is located in southwestern Virginia 27 miles west-southwest of Roanoke at an altitude of 2,005 feet. It is in the center of an agricultural and bituminous coal area, and canned goods, furniture, lumber, and clothing are the principal manufactured products. There are also stockyards in the town, which is served by the Norfolk and Western Railroad. Christiansburg was founded in 1792 and incorporated in 1916. Pop. (1950) 2,967.

CHRISTIANSHAAB, krës'tyáns-hóp, settlement, Greenland, seat of a district with the same name, is situated on Disko Bay on the western coast of Greenland 40 miles east-northeast of Egedesminde. It is a fishing and hunting base and there is seal-oil refining. The settlement, which was founded in 1734, has a population (1945) of 181, and the district has a population (1945) of 648.

CHRISTIANSTED, krís'chän-stëd; Dan. krës'tyán-stëth, town, capital of Saint Croix Island, Virgin Islands of the United States, is located on the northern coast of St. Croix, 45 miles south-southeast of Charlotte Amalie on St. Thomas Island. Lying on a picturesque coral-bound bay, the city was formerly the capital of the Danish West Indies. Sugar and semi-tropical fruits and vegetables are grown in the surrounding region. The town is called Bassin by the older natives. Pop. (1950) 4,112.

CHRISTIANSUND. See KRISTIANSUND.

CHRISTIE, krís'ti, Agatha Mary Clariessa (nee MILLER), English detective-story writer: b. Torquay, Devonshire, England, 189? Privately educated, she later studied music in Paris, and in 1914 was married to Col. Archibald Christie from whom she was divorced in 1928. In 1930 she

married Max Mallowan, an archaeologist, whom she has accompanied on several archaeological expeditions to Syria and Iraq. Beginning with her first detective story, *The Mysterious Affair at Styles* (1920), the novels of Agatha Christie have achieved an international popularity, and in the neat little Belgian detective, Hercule Poirot, with his intuitive methods and his great confidence in his own "little grey cells," she created a celebrated literary character in the tradition of Sherlock Holmes. Her best-known detective story is *The Murder of Roger Ackroyd* (1926).

Other detective stories by Agatha Christie include *Peril at End House* (1932); *Murder in the Calais Coach* (1934); *Dead Man's Mirror* (1937); *And Then There Were None* (1940); *The Crooked House* (1949); *A Murder is Announced* (1950); *They Came to Baghdad* (1951).

CHRISTIE, Annie Rothwell (nee FOWLER), Canadian poet and novelist: b. London, England, Mar. 31, 1837; d. New Liskeard, Ontario, Canada, July 2, 1927. She migrated to Canada in early life and settled on Amherst Island near Kingston, Ontario, later moving to Ottawa. The contributor of short stories to Canadian, American, and English periodicals, she also wrote for the *Magazine of Poetry* and received high praise from Sir Edwin Arnold for her verses dealing with Riel's Rebellion. Her novels include *Alice Gray* (1873), *Edged Tools* (1880), *Requital* (1886), and *Loved I Not Honour More* (1887).

CHRISTIE, James, English auctioneer and founder of a line of London auctioneers: b. 1730; d. London, Nov. 8, 1803. He resigned a naval commission to become an auctioneer, his first sale taking place in 1766. Two years later he moved to premises in Pall Mall, and his rooms were shortly used as exhibition galleries by the Royal academicians. Within a few years his auction rooms had become the chief center in Europe for the distribution of works of art and an important rendezvous for fashionable society. He was an intimate friend of Thomas Gainsborough, who painted his portrait, Sir Joshua Reynolds, and David Garrick.

His son, JAMES CHRISTIE (b. London, 1773; there, Feb. 2, 1831), entered the elder Christie's business, carrying it on with increased success after the father's death. A critic of fine arts, the younger Christie did considerable antiquarian research on Greek and Etruscan vases and sculpture. His own sons, JAMES STIRLING CHRISTIE (d. 1834) and GEORGE HENRY CHRISTIE (d. 1887), carried on the firm after his death. In 1859, with later partners, the firm acquired the present name of Christie, Munson, and Woods; however, the Christie family's connection with the business ceased in 1889 upon the retirement of JAMES H. B. CHRISTIE, the son of George Henry Christie. For most of its nearly two centuries of existence Christie's has been one of the most important art centers of the world and as such has seemed to many more like a British national institution than a commercial firm.

SAMUEL HUNTER CHRISTIE (b. London, Mar. 22, 1784; d. Twickenham, Middlesex, Jan. 24, 1865), another son of James Christie, the elder, achieved fame as a mathematician. As assistant in and later professor (1838-1854) of mathematics at the Royal Military Academy at Woolwich, he helped transform the examination system of the academy. He made numerous experiments in the fields of magnetism and the conductivity of metals,

and was elected a fellow of the Royal Society in 1826.

The eldest son of S. H. Christie, Sir WILLIAM HENRY MAHONEY CHRISTIE (b. Woolwich, London, Oct. 1, 1845; d. at sea, Jan. 22, 1922), was noted as an astronomer. Following his education at King's College, London, and Trinity College, Cambridge, Christie in 1870 was appointed chief assistant at the Royal Observatory, Greenwich. He succeeded Sir George Biddell Airy as the astronomer royal in 1881, and during his term of office, which ended in 1910, activities at the Greenwich Observatory were expanded considerably. At this time a 30-inch reflector and a 26-inch photographic refractor were erected, new buildings were added, and photographic and spectroscopic observation techniques were developed. Christie designed an altazimuth and made several expeditions for observations of solar eclipses. Elected to the Royal Society in 1881, he was also prominent in the activities of the Royal Astronomical Society.

Consult Colson, Percy, *Story of Christie's* (London 1951).

CHRISTIE, Richard Copley, English scholar and bibliophile: b. Lenton, Nottinghamshire, England, July 22, 1830; d. Ribsden, Windlesham, Surrey, Jan. 9, 1901. As a teacher, administrator, and benefactor, Christie served Owens College (q.v.) in Manchester throughout his lifetime. Educated at Lincoln College, Oxford, he began his career as a teacher at the newly founded Owens College where he simultaneously held chairs in history, political economy, and law. He was called to the bar from Lincoln's Inn in 1857 and practiced law from 1857 to 1877. With the reconstitution of Owens College in 1870, Christie became one of the governors, to be a lifetime position, and a member of the college council, a seat he held until 1886. From 1872 to 1894 he also held the position of chancellor of the diocese of Manchester. He donated to Owens College the Christie Library, which was opened in 1898, and bequeathed to it his personal library of 75,000 volumes rich in Renaissance literature. After his professional retirement he devoted much time to scholarly researches, *Étienne Dolet, the Martyr of the Renaissance* (1880) being his first major publication.

CHRISTIE JOHNSTONE, a novel by Charles Reade, published in 1853. The story, by turns humorous and pathetic, abounds in vivid scenes of Scottish life by the sea. Into this tale Reade wove his art criticism favorable to the Pre-Raphaelites and opposed to the Royal Academy.

CHRISTINA, kris-tē'nà, queen of Sweden: b. Stockholm, Sweden, Dec. 8, 1626; d. Rome, Italy, April 19, 1689. The daughter of Gustavus Adolphus and Maria Eleanora of Brandenburg, she was educated in a masculine manner. Upon the death of her father in 1632, the Riksdag appointed five guardians to Queen Christina, the leading spirit in the regency being the powerful Count Axel Oxenstierna. In 1644 in her 18th year Christina took upon herself the government. A great talent for business and great firmness of purpose distinguished the first steps of the young queen. She terminated the war with Denmark and obtained several provinces by the treaty concluded at Brömsebro in 1645. Then, contrary to the advice of Oxenstierna, who hoped to gain still

greater advantages for Sweden by the continuance of the general war, she labored to re-establish peace in Germany in order to be able to devote herself uninterruptedly to the sciences and the arts of peace. Due to the queen's interference, Sweden's gains by the Peace of Westphalia concluding the Thirty Years' War were definitely reduced.

Although probably the most accomplished and learned woman of her time, she was of a restless, capricious, and extravagant nature; nevertheless, she did much to promote commerce, encourage manufactures, and patronize learned and literary institutions. She declined to marry her cousin, Charles Gustavus, prince of the Palatinate, but induced the Riksdag in 1650 to designate him as her successor. From that time Christina neglected her older ministers and listened to the advice of ambitious favorites, and soon the country was divided into two parties, the aristocrats led by Oxenstierna and the party of the people supported by the queen. Dissension, attempts at revolt, and the squandering of the property of the crown characterized this part of her reign. Distinctions were conferred upon the undeserving, producing jealous murmurs, complaints, and factions. In this state of confusion the queen declared her intention of abdicating the crown. She was, however, dissuaded from her resolution, and grasped with firmness once more the reins of government, though continuing to concern herself primarily with art, philosophy, and religion. To her court came many learned men, including René Descartes and Hugo Grotius, with whom she conversed familiarly on literary and philosophical subjects. But with new troubles, Christina, who loved whatever was uncommon, resumed her determination to resign the crown.

In the presence of the Riksdag in 1654 she finally laid aside the insignia of royalty to surrender them into the hands of Prince Charles Gustavus. She reserved to herself, nevertheless, a certain income, entire independence, and full power over her suite and household. She soon left Sweden for Brussels, where she made a secret profession of the Roman Catholic faith, which she afterward publicly confirmed in Innsbruck. From there she went to Rome and was confirmed by Pope Alexander VII. In 1656 she visited France, where her dress and manners produced an unfavorable impression, although her talents and knowledge were generally admired. While at Fontainebleau during a second visit in 1657 she had Giovanni Monaldeschi, her grand equerry, executed as a faithless traitor. Cardinal Mazarin succeeded in accelerating her departure from France under various pretexts.

After the death of Charles X Gustavus in 1660, the queen made a visit to Sweden under the pretense of wishing to arrange her private affairs, but it was soon perceived that she had other motives. Since Charles XI, the crown prince, was very young, she declared that in case of his death she would lay claim to the throne. This project was unfavorably received and she was compelled to sign a formal act of abdication. A second attempt in 1667 to recover the throne also failed. She aspired to the Polish crown, but the Poles took no notice of her wishes. Finally she returned to Rome, where she passed the remainder of her life cultivating the arts and sciences.

of Sweden, tr. from the German by Bernard Balogh (Toronto 1935).

CHRISTINE DE PISAN, krēs-tēn' də pē-sān', French author of Italian descent: b. Venice, Italy, 1364; d. in France, c.1430. She went to France in 1368 with her father who became court physician and astrologer to Charles V. Upon the death of her husband, Étienne de Castel, she began to write in order to support herself and her children, and it is said that she was the first woman since antiquity to gain a livelihood by literature. Her writings in verse and prose, which range widely over the fields of philosophy, travel, politics, history, and science, are in a style at times prolix but with elements of a touching melancholy and eloquence.

CHRISTISON, krīs'tī-s'n, **SIR Robert**, Scottish toxicologist and physician: b. Edinburgh, Scotland, July 18, 1797; d. there, Jan. 23, 1882. He graduated in medicine at Edinburgh University in 1819 and subsequently studied in London and Paris. Appointed to the chair of medical jurisprudence at Edinburgh in 1822, he did much to give a scientific basis to that field and especially to toxicology. As medical adviser to the crown in Scotland, he acted as a medical witness in numerous important legal cases. His instructions for the examination of corpses for legal purposes became the standard guide in this work. He made intensive studies on various poisons, publishing his *Treatise on Poisons* in 1829. From 1832 to 1877 he was professor of medicine and therapeutics at Edinburgh. Widely recognized as an authority on the pathology of the kidneys, Christison also published *Granular Degeneration of the Kidneys* (1839).

CHRISTMAS, the feast commemorating the birth of Jesus, observed by the Christian church annually on December 25. The name is derived from the medieval *Christes Masse*, the Mass of Christ. The celebration was not observed in the first centuries of the Christian church, since the Christian usage in general was to celebrate the death of remarkable persons rather than their birth. The death of the martyr Stephen and the massacre of the innocents at Bethlehem had already long been celebrated, when, perhaps in opposition to the doctrine of the Manichaeans respecting the birth of the Saviour, a feast was established in memory of this event in the 4th century. In the 5th century the Western church ordered the feast to be celebrated on the day of the Mithraic rites of the birth of the sun and at the close of the Saturnalia, as no certain knowledge of the day of Christ's birth existed. Among the German and Celtic tribes the winter solstice was considered an important point of the year and to commemorate the return of the sun they held their chief festival of yule, which, like other pagan celebrations, became adapted to Christmas.

Most of the customs now associated with Christmas were not originally Christmas customs but rather were pre-Christian and non-Christian customs taken up by the Christian church. Saturnalia, a Roman feast celebrated in mid-December, provided the model for many of the merry-making customs of Christmas. From this celebration, for example, were derived the elaborate feasting, the giving of gifts, and the burning of candles. Lights also played an important part in most winter solstice festivals. The giving of

gifts has varied considerably, many peoples exchanging presents on other days and reserving Christmas solely for religious observances. The Teutonic yule feast also provided customs for the Christmas festivities, such as the yule log and wassail bowl. In many places a part of the yule log is retained to light the yule log of the following year. The origin of the Christmas tree has been variously traced; however, the tree was not in wide usage until the 18th century. The Saxons made use of ivy and holly, and mistletoe in such festivities is a Celtic remnant. Nativity plays early became a part of the Christmas celebration, and about the 13th century merry songs on religious themes became an important part of the Christmas activities. The representation in church of the crèche is said to have been begun by Saint Francis. The sending of Christmas cards by way of friendly greeting and remembrance has grown up since the middle of the 19th century. In the United States the customs and traditions of many nationalities and faiths have gradually blended into common usage forming a new tradition.

CHRISTMAS CAROL, A, short story by Charles Dickens, published in 1843, which has become one of the most beloved stories of Christmas in English fiction. On Christmas Eve, Ebenezer Scrooge, a selfish, disagreeable merchant in London, returns to his living quarters with no thought of celebrating the holiday season. He has spurned an invitation to spend Christmas with his nephew Fred, and only begrudgingly granted a one-day holiday to his underpaid clerk, Bob Cratchit. When a request for charity is made of him in the name of his dead partner Jacob Marley, he answers that the Christmas spirit is wasteful and foolish. After Scrooge goes to sleep, three apparitions appear to him: the ghosts of Christmas Past, Christmas Present, and Christmas Yet to Come. Their appearance results in a complete change in Scrooge, who becomes generous, kind, and thoughtful to relatives and his fellowmen on Christmas Day and for all days to come.

The most frequently quoted lines occur between Bob Cratchit and his crippled son, Tiny Tim. Bob makes the toast: "A Merry Christmas to us all, my dears. God bless us," to which Tiny Tim replies: "God bless us every one."

CHRISTMAS ISLAND, in the Indian Ocean, a hilly, isolated island 223 miles south of Java Head, owned by Great Britain. It is approximately 11 miles long and $4\frac{1}{2}$ miles in minimum width, the area being about 60 square miles. The hills, which rise to a height of some 1,000 feet, are covered with deposits of guano from which a considerable volume of phosphate of lime is derived. The employed persons, largely Chinese and Malays, work for the Christmas Island Phosphate Company, which exports the phosphate of lime. The island was known to the Dutch in the 17th century and was annexed by the British on June 6, 1888. It was placed under the control of the governor of the Straits Settlements in 1889 and incorporated with the Settlement of Singapore in 1900. The island was occupied by the Japanese for a time during World War II. Pop. (est. 1952) 1,639.

CHRISTMAS ISLAND, in the central Pacific Ocean, a low atoll of Polynesia, owned by

Great Britain, and situated in the Line Islands approximately 160 miles southeast of Fanning Island. Covering about 222 square miles, it is the largest atoll in the Pacific. The island was discovered in 1777 by Capt. James Cook, was annexed by Great Britain in 1888, and was included in the Gilbert and Ellice Islands Colony in 1919. It is on a long-term lease to a coconut plantation company, and copra is produced. The United States advanced claims to the island in 1856 and in 1936. Pop. (1950) 250.

CHRISTMASBERRY, an evergreen shrub, *Heteromeles arbutifolia* (also *Photinia arbutifolia*), native to California and Lower California and used widely for ornamental purposes. It customarily reaches a height of 5 to 15 feet. The thick, dark green leaves are oblong in shape, with sharp-toothed edges, and average about four inches in length. The flowers are white and the berries yellow or bright red, the latter being widely used as Christmas decorations. The Christmasberry is often known as the toyon.

CHRISTOFFEL, kri-stôf'ël, **Elwin Bruno**, German mathematician: b. Montjoie (now Monschau), Germany, Nov. 10, 1829; d. Strasbourg, Germany, Mar. 15, 1900. Professor of mathematics at Zurich, Berlin, and Strasbourg (after 1872). Christoffel did much significant work in higher mathematical analysis and mathematical physics. The Christoffel symbols, which play an important role in the theory of quadratic differential forms, are named after him.

CHRISTOLOGY, kris-tôl'ô-jî, the doctrine of the person and work of Christ, that is, his nature, both human and divine, his incarnation, his revelation of God, his miracles or "mighty works," his death (which effected the atonement or redemption of mankind from sin), his resurrection and ascension, his glorification, his heavenly intercession, and finally his coming again in glory to hold the Last Judgment.

The Creedal Statements.—The old Latin baptismal creed known as the Apostles' Creed, whose earliest form can be traced back to the 2d century, affirms the Christian belief "in God . . . and in Jesus Christ his only Son our Lord; who was conceived by the Holy Spirit, born of the Virgin Mary, suffered under Pontius Pilate, was crucified, died, and was buried; he descended into Hades; the third day he rose again from the dead; he ascended into heaven, and sits at the right hand of God the Father Almighty; from thence he shall come to judge the living and the dead."

The so-called Nicene Creed (q.v.), which is really a modification of the creeds formulated at Nicaea in 325, and at Constantinople in 381, amplifies this doctrine as follows: "We believe in one Lord Jesus Christ, the only-begotten Son of God, begotten of his Father before all worlds, God of (literally from) God, Light of Light, true God of true God; begotten, not made; consubstantial with the Father; by whom all things were made; who for us men and for our salvation came down from heaven, and was incarnate by the Holy Spirit of the Virgin Mary, and was made man. He was crucified for us under Pontius Pilate; he suffered and was buried; the third day he rose again according to the scriptures; and ascended into heaven. He sitteth at the right hand of the Father; and he shall come again with

glory, to judge both the living and the dead; and His kingdom shall have no end."

The so-called Athanasian Creed, which was really a 6th century anti-Priscillianist formula, probably from Spain or southern Gaul, is concerned chiefly with the exact definition of the relations between the Father, the Son, and the Holy Spirit, the three "persons" within the Blessed Trinity. Taken for granted in this creed is the earlier doctrine of Christ's deity, such as the statement adopted at the Council of Chalcedon in 451 that Christ has two natures, human and divine, which are united "inseparably" (*adiare-tōs*) and yet "unconfusedly" (*asynchytōs*), and that he is both "truly" (*alēthōs*) God and "perfectly" (*teleiōs*) man. These four terms set the boundaries of speculation for all later orthodox theology.

But it is not only in the creeds, or in the systematic theology which expounds them, that the doctrine of Christ is set forth. Hymns, prayers, homilies and sermons, the liturgy, devotional books, and works of art likewise state it, two important examples of the latter being *The Imitation of Christ* by Thomas a Kempis and Johann Sebastian Bach's *Jesu, Joy of Man's Desiring*. Like all basic or fundamental religious doctrines, this doctrine of Christ too is no mere result of theological speculation or of rational inference from sacred texts; it expresses the deep personal conviction and faith which lie at the heart of the Christian religion.

Conceptions and Titles of Christ.—The origin of this conviction can be traced in the New Testament, where the disciples of Jesus, who at first looked upon him as a teacher and prophet, "mighty in word and deed, and in favor with God and all the people" (Luke 24:19; Acts 10:36-38), came to believe that he was the Messiah (or Anointed), the glorious future king of Israel who was to inaugurate the reign of God over the whole world (Mark 11:9-10; John 12:12-16; 1:41; Acts 1:6). As reflected in the Gospels, this growing faith was essentially a religious conviction, derived from the impression of Jesus' teaching, character, "mighty works" of healing and exorcism, and the authority (Matthew 7:29) with which he spoke and acted as God's agent and representative. His works of healing and exorcism were proofs, not of personal prerogatives so much as of the approach of the divine reign or "the kingdom of God" (Matthew 12:28), although the implication that Jesus is "more than a prophet" is also clear (as in Matthew 11:2-6, where Jesus does not define his own title explicitly—he is simply "the coming one").

In lieu of signs and wonders, which men desired to see as evidences of supernatural authority, Jesus himself was the "sign" to his generation (Mark 8:11-12; Luke 11:29-32). The heart of Jesus' message was the proclamation of the near arrival of the kingdom of God; his mission consisted in preparing men to enter it, in "binding the strong man," and in rolling back the powers of darkness. It was all but inevitable that his disciples should look upon Jesus as the destined Messiah (Mark 8:27-30).

At the same time the Gospels bear witness to the early use of another term, "The Son of Man," which had even more exalted supernatural connotations (Mark 13:26). In the Jewish Bible, the term "son of man" meant simply "human being" (Ezekiel 3:10; Psalms 8:4); but the title "*The Son of Man*" (derived from Daniel 7:13) had

come to mean, technically, as in the Book of Enoch (46:3-6), the heavenly being who was with God when He created the world, and who will come on the clouds of heaven to judge the world on the Last Day (Matthew 25:31-33)—a figure reminiscent of Zoroastrian speculation. In the Gospels (for example, Mark 8:38; 14:62) this title is implicitly claimed by Jesus, although the references to his impending rejection, sufferings, death, and resurrection (as in Mark 8:31; 9:31; 10:32 ff.) only hint at the identification, and may be later insertions into the tradition. They stress the tremendous paradox of the cross: the divine, heavenly Son of Man must die! Whether or not the disciples already looked upon Jesus as The Son of Man, in addition to viewing him as the Messiah, is uncertain, as is also the precise sense in which Jesus used the term. But after the Resurrection there was no hesitation in ascribing to him the more transcendent title, with its connotations of exaltation, divine rank, and future coming (*parousia*) to hold the final judgment.

In the earliest stage of Christian doctrinal development, in the early Christian-Jewish communities in Palestine, this concept was normative. The ancient Aramaic invocation which survives in I Corinthians 16:22 attests this early Christology: *Marana tha*, meaning "Our Lord, come!" (cf. Revelation 22:20; Didache 10:6.) The title is not so much theological as religious, and reflects the faith of the early Christians in Jesus as a divine, supernatural being, upon whom all their hopes of salvation, both here and hereafter, depend. This faith requires expression, and the only adequate term available to the early Palestinian Christian-Jews, who were monotheists, and whose Bible was the Old Testament, was this transcendental one found in contemporary apocalyptic writings.

It was when the church spread beyond the borders of Jewish territory, to the east and west outside Palestine and also outside the settlements in the Jewish Diaspora, especially in the West, that other terms or titles became necessary. "Son of Man" was not understood by Greek-speaking Gentiles: to them it seemed to mean "the son of the man" or "son of a man," since they were unfamiliar both with Semitic idiom and with the Jewish apocalypses. Even the term "Messiah" was meaningless; it meant, literally, "anointed with oil" (*chrism*), and was either merely transliterated into Greek or, if translated, was understood either as a proper name or as a bizarre Oriental title. *Christos*, often confused with the Greek word *chrēstos* (gentle).

In the letters of Paul and also in Hebrews, "Christ" is used almost exclusively as a proper noun, part of the name "Jesus Christ," and no longer as a title, although its divine connotations are retained. Paul never uses the title "Son of Man," "Messias" (the Greek transliteration of Messiah), or "King of Israel," nor does he use the title "Rabbi" for Jesus. The great Christological passage in Philippians 2:5-11 might suggest the eschatological title, "Son of Man"; but instead the title used is "Lord." (I Corinthians 15:47 is sometimes cited as an example; but here no title appears, and the passage is an exposition of Genesis 2:7.)

It was inevitable that the Greek-speaking Gentile churches should use Greek religious terms and titles, and they chose those which were richest in meaning. "Son of God," which was not a common Messianic title among the Jews in

spite of Psalms 2:7, was perhaps the earliest to be adopted. "Saviour" (*Sōtēr*), another such title, had the advantage of being equally applicable to a divine or to a human being, and therefore to one who was both. Commonest of all, in the early Gentile churches, was "Lord" (*Kyrios*), which meant, in religious circles, the head of a cult, a divine being who was worshiped by a group, such as a city, a nation, or, later, a church. It was also known to Greek-speaking Jews and Christians as the translation of the Hebrew name for God (*Yhwh*) in the Septuagint. The earliest Gentile creed was probably simply "Jesus is Lord" (1 Corinthians 12:3), or possibly *Kyrios Christos* ("Christ is Lord"). The consequence of the adoption of this title, which would have been impossible in Palestine (though *Mar*, in 1 Corinthians 16:22, approaches it), was that many passages in the Old Testament referring to God were interpreted as referring to Christ. Finally, in circles where Gnostic or theosophical speculation was growing, the term "Logos" (Word, Thought, Reason, Purpose, or Utterance of God) was adopted (John 1:1-14; in Colossians 1:15-20 the idea is present, but not the term).

The term "Logos" was originally derived from philosophical speculation, and was widely popularized by Stoic teaching; however, its use, in the 1st century, was not limited to the philosophers. The idea of a divine Logos was found in many different cults and sects, as an expression of the principle of mediation between God and the world, not only in creation but also in the maintenance of the universe (Colossians 1:17).

Other titles were used in the Gentile churches, some of them derived from the Old Testament, as Mediator, Sacrifice, Lamb of God, Passover, High Priest, Prince, Captain, Child of God, Servant of God; others from the noblest religious teaching and aspiration in the Gentile world, as Invincible Sun, Splendor of God, Life, Light, Water of Life, Living Bread, Master, King, King of Kings; and still others from the church's own creative spiritual and devotional activity.

The variety in the titles applied to Christ by the early church is surprising. They match, and even exceed, those ascribed to the other deities in the ancient world. The church was entering upon its whole inheritance, not only from Judaism and the Old Testament, but also from the age-old religious devotion and aspiration of the entire civilized world. It used to be maintained that the church abandoned the purity of its pristine faith, as it spread through the Graeco-Roman world; that it accommodated itself to Greek, Roman, Egyptian, and Syrian mythology, and let its message be silenced and neutralized by philosophical speculation, until, eventually, the long centuries of controversy completely stifled the original gospel of Jesus.

But modern scholarship recognizes that these controversies were inevitable. The variety in the conceptions of Christ set forth even in the New Testament, the philosophical or scientific problems which they set (chiefly the profoundest problem of all: How can one person be both God and man?), the necessary reinterpretation of the Old Testament from the standpoint of the Christian view of Christ (especially as "Lord"), the requirement of a whole new set of terms for expressing the Christian dogma (or of old terms, such as "nature," "person," "substance," "will," with new meanings)—all these were problems which no Greek of the 2d to 5th century could

leave unsolved, whatever the cost in time, effort, or equanimity.

Moreover, modern research in social psychology and the history of religions has shown that the symbols used by the early church (especially those of Messianic King, Saviour, Redeemer, Revealer, Lord, Final Judge, Son of Man, Logos, and High Priest) have deep and permanent significance for the total life of mankind. They belong to the primeval structure of human thinking; what the church did was to provide for these basic needs a supernatural satisfaction.

Christological Controversies.—The Christology of the 2d century was partly adoptionist, that is, Christ *became* God by virtue of his noble character, pure teaching, and martyr death; this view simply applies the popular euhemerist explanation of the pagan gods as deified men, who had been founders of cities, inventors of arts, benefactors of mankind, or heroes. It was also partly monarchian, viewing God as a single Person, a unitary mind or will, who nevertheless manifested himself in different modes (hence modalism), such as the Father, Son, Spirit, Saviour, or Lord. This view reflects the influence of another type of pagan thought, in which Zeus, Jupiter, Jove, Amon, and Baal were merely different names for the one true God, who was nevertheless known to different nations under these different names. But as against both adoptionism and modalism (modalistic monarchianism), the church insisted on the true deity of Christ and his distinction in person from the Father. Neither monarchianism nor Gnosticism, which was also rife in the 2d century, contributed, except negatively, to the development of Christology.

The long period of Christological controversy opening in the 4th century was inaugurated by the attempt of Arius to define Christ as the "first of creatures," meaning a created and not an eternal being. Arius took his start from Paul's phrase, "the firstborn of all creation" (Colossians 1:15), from which his inference followed that "there was a time when the Son was not." This view provoked widespread controversy the orthodox doctrine being defended almost single-handedly by Athanasius of Alexandria (*Athanasius contra mundum*). The Arian doctrine was branded as heretical and rejected at the Council of Nicaea in 325. (See also ARIANISM.)

Once the relation of the Son (Christ) to the Father was defined—the Son being viewed as eternal, begotten before all creation and distinct in person from God the Father though one with him in substance, nature, and will—it became necessary to define the relation between the divine nature and the human in the Incarnation of the Son. Although the controversies were greatly complicated by political motives and by the rivalries of different schools and patriarchs, the main alternative answers were theological. By some it was held impossible to think of the divine and human natures of Christ as distinct: God could not be a child, or have a mother, or grow in grace! Therefore Christ's divine nature must have swallowed up the human, as a drop of water merged in the ocean; or the divine nature must either embrace or supplement the human, with a resulting unity and homogeneity; or form a single new nature combining both.

But the church as a whole, clinging firmly to scripture and tradition, refused to accept any of these alternatives and thus sacrifice the his-

torical reality of Jesus' true human nature, the distinction of his human person from God, and his distinctiveness from all other human persons. The views of Eutyches and Nestorius, of Apollinaris of Laodicea and Theodore of Mopsuestia, and of Sabellius and Paul of Samosata were rejected by the majority decisions of successive councils. The resulting definition of the nature of Christ (strongly influenced by the dogmatic letter which Pope Leo I sent to Flavian of Constantinople in 449, just before the Council of Chalcedon in 451) was highly metaphysical and difficult to conceive—like many of the formulas in mathematics and physics—but it safeguarded (1) the cardinal and essential monotheism of the Christian faith; (2) the truth of divine revelation; (3) the historical reality of Jesus' human nature, character, life, and teaching; and (4) the distinction between the divine Persons in the Blessed Trinity. The solution was not a compromise, but a safeguard of the essential truths of the Christian faith. Although strictly unimaginable and indescribable, the distinction between the divine Persons and the union of the two natures in Christ were principles which (granted the meaning of the language used in that long era of controversy) simply could not be abandoned if Christianity was to continue what it had been from the beginning: faith in God as revealed in Christ.

Later developments in Christology included Monothelism, which found the unity of Father and Son in the unity (identity) of two wills; Unitarianism, for which Christ is purely human, though possessing "divine" qualities of character, leadership, and heroism; such modern theories as Ritschlianism, in which Christ has the "value" of God, or the view of William Sanday that Christ's relation to the Father existed in his "subconscious"; and many others, ranging from an *avatar* in a long series of divine manifestations to the projection of a "Christ Idea," the "Christ myth" theory of the early 1900's. None of these later views, however, is characteristic of the main stream of historical Christian theology.

See also **BIBLE**—*Religion and Theology of the New Testament*; **CHRISTIAN DOCTRINE, DEVELOPMENT OF**; **INCARNATION**; **JESUS CHRIST**.

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FREDERICK C. GRANT.

CHRISTOPHE, Henri, king of Haiti: b. Grenada, West Indies, Oct. 6, 1767; d. Oct. 8, 1820. He was an African slave who received his freedom as a reward of faithful service. On the outbreak of the Negro insurrection in San Domingo, 1791, he became one of its leaders, and attracted by his energy and ability the attention of Pierre Dominique Toussaint L'Ouverture, who conferred upon him a divisional military command. After the deposition of Toussaint, Christophe served under his successor, Jean Jacques Dessalines, and waged a war of increasing feroc-

ity against the French, who in 1803 were compelled to evacuate the island. In 1811 Christophe obtained undisputed possession of a portion of the island, and was proclaimed Henri I, king of Haiti. His reign was despotic and sanguinary. See also **HAITI**.

CHRISTOPHER, krīs'tō-fēr, **Saint**, a saint whose name and feast are celebrated, but whose history is little known. He is reported to have been a native of Syria, who was baptized by Saint Babylas, bishop of Antioch, and received the crown of martyrdom in Asia Minor about the middle of the 3d century. Relics of him are found in several places, principally in Spain. The Eastern Church celebrates his festival on May 9; the Western on July 25. His intercession was particularly sought in the time of the plague. Christopher literally means "bearer of Christ." He is represented as a giant, bearing the child Jesus upon his shoulders over a stream, which refers to a legend of this saint.

CHRISTOPHER, antipope: r. 903–904. A cardinal priest, he imprisoned Leo V and seized the papal throne, but in turn was ejected by Sergius III, who ordered his and Leo's execution. Roman tradition placed him in the list of legitimate popes, but now he is considered an antipope.

Consult Duchesne, L., ed., *Liber Pontificalis*, vol. 2, p. 235 (Paris 1892).

CHRISTOPHER NORTH, pseudonym of John Wilson, the Scottish author (q.v.).

CHRISTOPHLE, Abert Silas Médéric Charles, French politician and administrator: b. Domfront (Orne) 1830; d. Paris, 1904. Named prefect of Orne in 1870, but resigned; elected to the National Assembly in 1871 and 1887. In 1876 he became minister of public works and was named governor of the Crédit foncier de France 1878–1895.

CHRISTOPOULOS krē-stō'pōō-lōs, **ATH-ANASIOS**, āth'ā-nā'shī-ōs, Greek lyric poet b. Kastoria, Macedonia, 1772; d. Wallachia, Jan. 29, 1847. He studied medicine and the sciences at Budapest, and finally settled at Hermannstadt in Transylvania. An epicurean, he celebrated sensual indulgences in his *Erotika and Bacchika*, or *Love and Drinking Songs*, which have been several times collected and printed under the title of *Lyrika*. Though partly modeled upon Anacreon and the songs of Alexis Piron, Marc Antoine Désaugiers and other French authors, they display so much ease and simplicity, tenderness and grace, as to entitle him to the name of the modern Anacreon.

CHRIST'S HOSPITAL (generally called the Blue Coat School, from the costume of the pupils), a school in London, founded by Edward VI, for supporting poor orphans. There used to be from 1,000 to 1,200 boys and girls at this establishment receiving instruction, board and clothing, the girls being comparatively few in number. The ages varied from 8 or 10 to 15 or 16, five of the best scholars being sent each year to Oxford and Cambridge. An entirely new scheme of management came into operation in 1891, according to which the preparatory school (established in 1683 at Hertford) has 120 pupils, the boarding school for boys 700, and the girls' school 350; a day school for 600

boys, and another for 400 girls being also provided for. No Blue Coat boy ever wears a hat or cap, winter or summer. They wear knee breeches, yellow stockings, and long blue coats with a leather belt. Entrance to the Hospital schools is partly by nomination or presentation, partly by competition; and in regard to two thirds of the scholars, fees may be charged if the parents or relatives are judged to be able to contribute to the child's education and maintenance. Numerous exhibitions and prizes still remain, including exhibitions to the universities. Situated in Newgate Street, London, since 1552, Christ's Hospital was pulled down in the year 1902 and the institution removed to Horsham.

CHRIST'S-THORN, a small thorny shrub of the order Rhamnaceae, or buckthorn family. The most common, *Paliurus spina-christi*, flourishes in the southeast of Europe and Asia Minor, especially in Palestine. The spines are long and sharp, growing on slender vine-like branches, the flowers rose-shaped. The plant derives its name from its being believed to be the plant from which the crown of thorns was made which was placed on the head of our Saviour. The fruit is called jujube, *Zizyphus jujuba*.

CHRISTY, kris'ti, **Howard Chandler**, American artist and illustrator: b. Morgan County, Ohio, Jan. 10, 1873; d. New York, N. Y., March 3, 1952. After attending school at Dun-can Falls, Ohio, he went to New York in 1893 to study art under William M. Chase. He soon decided to be an illustrator. He went to Cuba during the Spanish American War and drew pictures of Teddy Roosevelt's "Rough Riders" in action. His illustrations appeared in *Harper's* and *Scribner's* magazines, and in *Collier's Weekly*, and he gained especial prominence with his "Men of the Army and Navy" series. He is, however, best known for his illustrations of the works of such authors as James Whitcomb Riley and Richard Harding Davis. Within a few years he had unconsciously created a feminine type, known as the Christy Girl. After 1920, he returned to portrait painting. He also painted *Signing the Constitution*, a large historical painting in the Capitol, Washington, D.C.

CHRODEGANG, krō'dē-gāng, or **GODE-GRAND**, gō'dē-grānd, **Saint**, bishop of Metz: b. about 700; d. Metz, March 6, 766. He was a descendant of a noble Frankish family. Pepin the Short, in 742, appointed him bishop of Metz. He was the author of the rule *Vita Canonica*. Feast day, March 6.

CHROMATES. See **CHROMIUM**.

CHROMATIC, in music, a succession of semitones, ascending or descending. The chromatic semitone is the interval between any given note and that same note raised by a sharp or lowered by a flat. The chromatic scale consists of 13 tones, the 8 scale tones and the 5 intermediate. It is believed by some that the term chromatic was adopted because the Greeks were in the habit of designating the intermediate ones by characters of various colors.

CHROMATIN. See **CELL**; **CHROMOSOME**.

CHROMATOGRAPHY, krō-mā-tōg'rā-fī,

is a method of chemical analysis which utilizes the differential countercurrent distribution of the components of a mixture between a fluid phase and an interfacial phase. In chromatography the distribution is commonly of the adsorption type occurring between a bulk phase (usually fluid) and an interfacial phase (usually fluid-solid); the term has been broadened, however, to include partition chromatography in which two fluid phases are used, the distribution involving a combination of liquid-liquid distribution and adsorption.

Credit is generally and properly given to Michael Tswett (Mikhail Semenovich Tsvett, 1872-1919), a Russian botanist, as the "true inventor of chromatography in all its important aspects." In 1906, Tswett, at the age of thirty-four, published an article in the *Berichte der deutschen botanischen Gesellschaft* in which he described with remarkable clarity and insight the general nature and scope of chromatography:

"There exists a certain adsorption sequence, according to which substances are able to replace one another. The following application is based on this law. If a petroleum ether solution of chlorophyll is filtered through a column of adsorbent (I use mainly calcium carbonate which is stamped firmly into a narrow glass tube), then the pigments, according to the adsorption sequence, are resolved from top to bottom into various colored zones, since the stronger adsorbed pigments displace the weaker adsorbed ones and force them farther downwards. This separation becomes practically complete if, after the pigment solution has flowed through, one passes a stream of pure solvent through the adsorbent column. Like light rays in the spectrum, so the different components of a pigment mixture are resolved on the calcium carbonate column according to a law and can be estimated on it qualitatively and also quantitatively. Such a preparation I term a chromatogram and the corresponding method, the chromatographic method. It is self-evident that the adsorption phenomena described are not restricted to the chlorophyll pigments, and one must assume that all kinds of colored and colorless chemical compounds are subject to the same laws."

Tswett's invention received scant attention in the scientific centers until the announcement in 1931 by Richard Kuhn and Edgar Lederer that crystalline plant carotene, long regarded as a single chemical compound, had been separated in macro amounts into two components by adsorption chromatography. Scientific interest in the carotenoids, because of their relationship to vitamin A, caused attention to be focused on the neglected technique of chromatography, with particular emphasis being placed on the development of techniques which would permit separation of mixtures of chemical compounds on the preparative scale. Since 1931 interest in chromatography as an indispensable laboratory aid has become worldwide.

Nature of Chromatography.—Adsorption chromatography employs the process of adsorption (the distribution of molecules between a fluid phase and a fluid-solid interfacial phase) in a countercurrent manner (the two phases move in opposite directions relative to one another). Any arrangement which utilizes countercurrent adsorption may be used: the adsorbent may be packed in a container of any shape; the fluid may flow in any direction, for example,

upwards or downwards through a column or radially through a bed. Moreover the fluid may remain stationary and the solid adsorbent be caused to flow in a definite direction through the fluid; or both phases may be caused to flow in opposite directions through one another. For simplicity and ease of control, the adsorbent is usually packed in columnar form in a glass tube, and the fluid phase containing the material to be analyzed is made to pass either up or down through the adsorbent.

In order to describe the nature of chromatography one may consider a hypothetical arrangement in which a solution consisting of a solvent *S* containing a chemical compound *X* (the solute) is introduced at the top of a column packed with adsorbent *C*. Compound *X* will possess a certain affinity for adsorbent *C* and a certain affinity for solvent *S*. (The affinity of the solvent for the adsorbent will be neglected in this consideration.) The ratio of the affinity of *X* for the fluid phase to its affinity for the interfacial phase is termed the distribution coefficient for *X*. If the distribution coefficient is 1, *X* tends to distribute itself equally between *S* and *C*; if the distribution coefficient is less than 1, *X* has a greater affinity for *C* than for *S*; whereas if the coefficient is greater than 1, *X* tends to accumulate in *S*. The distribution coefficient is dependent on the nature of *S* and of *C*, and on the chemical architecture of *X*, and, for the adsorption distribution, on the concentration of *X* in *S*, and on the temperature. As the solution percolates through *C*, *X* is brought into contact with the solid at the liquid-solid interface. Ideally, then, the amount of *X* in *S* and the amount of *X* adsorbed on *C* reach an equilibrium state. (In practice, equilibrium conditions are probably not ever established.) As the countercurrent process occurs, *S*, containing that amount of *X* remaining in solution, passes on to fresh *C*, permitting absorption of *X* from the solvent on the fresh adsorbent. Simultaneously, fresh solution comes in contact with the original zone of adsorption, and further adsorption occurs there. This process continues until all *X* is adsorbed and pure *S* passes out of the column. *X* will then be adsorbed in *C* in a discrete zone at or near the top of the column. If there are two or more solutes dissolved in *S*, they will all be adsorbed as described above. But, because of the competition among the different compounds for the liquid-solid interfacial area, the solutes that are more strongly adsorbed under the conditions employed will saturate the immediately available adsorbent and thus effectively displace the less strongly adsorbed materials. The latter will appear farther down the column as more or less discrete zones arranged in the order of their decreasing relative affinities for the adsorbent. As the final portion of the solution passes into *C*, fresh *S* (or a different solvent) is added at the top of the column in order to develop the chromatogram. When the fresh solvent passes through a zone of adsorbed material, desorption occurs, the adsorbed material passing into solution. This desorption and solution continues until equilibrium (ideally) is established between the amount of *X* in the solvent and the amount of *X* in the adsorbent. Then, as the solution containing desorbed material passes on to fresh adsorbent, adsorption again occurs as originally described. Thus the zone is carried in the direction of the fluid flow. The rate of movement of

the zone is dependent on the rate of fluid flow and on the distribution coefficient of the solute. The more strongly adsorbed material will move slowly relative to the solvent with a large distribution coefficient. In this manner complete separation of the zones may be achieved: that is, the chromatogram is developed. At this point the adsorbate may be extruded from the glass tube, and the zones separated mechanically. The adsorptives may be recovered from the sectioned zones by solution in an appropriate solvent; usually this solvent is one for which the adsorptive has a high affinity. Often, however, a more powerful developing solvent is added directly to the column to complete the passage of the zones from the bottom of the column where they may be collected as individual fractions. The developing solvent in this process is termed the eluent, and the process is known as elution analysis or liquid chromatography. A modification of elution analysis developed by Arne Tiselius is known as displacement analysis. This method utilizes a developing material which is more strongly adsorbed than any of the substances to be analyzed. Therefore, on addition of the developer, the zones representing the components of the original mixture are displaced by the developer and pass off the column as separate fractions. According to Tiselius' graphic description, the developing solvent acts as a sort of piston to push out the zones.

Partition Chromatography.—The method of partition chromatography for the qualitative and quantitative analysis of chemical mixtures was developed in 1941 by two English investigators, A. J. P. Martin and R. L. M. Synge. In this method two liquid phases are employed. One phase is sorbed on an inert support and is considered as the stationary phase. The mobile liquid phase passes over the stationary phase in a unidirectional flow so that countercurrent liquid-liquid distribution of the solute molecules occurs. (Generally, the liquid-liquid distribution is complicated by adsorption of the solute and mobile phase by the "inert" support.) Again, the components of the mixture to be analyzed can be characterized by a distribution coefficient which is defined as the ratio of the concentration of any given solute in the nonmobile phase to its concentration in the mobile phase. If the stationary liquid phase is considered analogous to the interfacial phase in adsorption chromatography, the nature of partition chromatography can be described as in the case of adsorption chromatography (see above).

Partition chromatography may be classified into bulk partition chromatography and paper partition chromatography. The former method employs a column of supporting adsorbent which has been equilibrated with the stationary liquid phase. A solution containing the different solutes to be analyzed is added to the top of the column followed by the addition of a suitable mobile liquid phase, that is, the developer. The analytical procedure is similar to that used in elution analysis. Martin, A. H. Gordon, and Synge have extended partition chromatography to include the use of paper strips and sheets as the supporting adsorbent whereby ultramicro amounts (of the order of 0.000001 gram) of material can be analyzed. In paper partition chromatography, the cellulose of the paper sorbs and holds aqueous solution as the nonmobile liquid phase. An organic solvent, saturated with water, the stationary solvent, is

used as the mobile developer. The mixture to be analyzed is applied in a small spot near one end of the paper strip. This end is dipped into a container of the mobile solvent, and the entire system is made airtight. The developing solvent flows along the paper by capillary action, either upward, downward, or across the paper, depending on the mechanical arrangements. After sufficient movement of the solvent, the paper is removed, dried, and examined by any suitable technique for the spots of the components of the analyzed mixture. In two-dimensional paper chromatography, a sheet of paper is used, and the mixture is applied in a spot near one corner. After development in one direction, the paper is removed from the container, dried, and developed with a different mobile solvent system in a direction at a ninety degree angle to the first direction, so that the individual spots of the substances separated by the first development now serve as points of origin for the second development. Greater resolution of mixtures is possible by two-dimensional analysis.

Technical Aspects of Chromatography.—Since the theory of chromatography has not developed sufficiently to permit accurate prediction of the action of any given adsorbent on any specific solute, the choice of adsorbent for investigational purposes is based largely on empirical trial. The adsorbent should have some selective action on the compounds to be analyzed. Further, it should be of a porous, stable nature with suitable particle size to furnish adequate contact with the adsorptives, and it is also necessary to select an adsorbent which has a high capacity but which does not bind the adsorptives reversibly. Preferably, the adsorbent should be colorless or white to permit ready recognition of the adsorptive zones. A partial list of adsorbents in use includes the activated charcoals, latomaceous earths, aluminas, sodium, magnesium, and calcium carbonates, sucrose, starch, silica, magnesium citrate, and 8-hydroxyquinoline. The recent use of exchange adsorbents (ion exchangers) in chromatography has given very promising results.

Only general considerations apply in the choice of solvents, including such age-old laboratory rules of thumb as "like dissolves like." Obviously, the solvent must be capable of dissolving the materials to be analyzed; but, equally obviously, the solutes must not be so soluble in the solvent that adsorption does not occur, nor the solvent so strongly adsorbed as to exclude solutes from the adsorbing surface. Solvents for development and solvents for elution analysis, when rapid removal of adsorptives is desired, should possess a great solubilizing action on the adsorptives. Moreover, solvents used in chromatography should not react irreversibly with the adsorbent or adsorptives. Among the many solvents employed are the aliphatic alcohols, ketones and ethers, aromatic and aliphatic hydrocarbons, and chlorinated aliphatic hydrocarbons.

Numerous techniques have been introduced for the location of zones on a column. Colored zones may, of course, be located visually. Colorless compounds may be converted to colored derivatives before chromatography. After development of a chromatogram containing colorless zones, the zones may be detected by application of reagents which react with the adsorptives to produce distinguishing colors. Colorless zones may often be defined by the fluorescence of the

adsorptive when the column is examined under ultraviolet light. Zones containing physiologically active materials may be detected by reference to standard biological assay methods. In elution and displacement analysis, the presence of the separated compounds in the collected fractions may be detected by examination of the fractions for any change in the chemical or physical properties such as hydrogen ion concentration, index of refraction, or conductivity.

The apparatus required for adsorption chromatography is simple indeed. The adsorbent is usually packed in a suitable glass tube. The only other necessary equipment is the usual laboratory glassware containers. Ingenious apparatus has been devised for use in paper partition chromatography. The reader is referred to the references at the end of this article for a full treatment of this subject.

Applications of Chromatography.—The versatility of chromatography may be emphasized by the following list of applications of the method:

- (1) Resolution of mixtures: identification, estimation, and isolation of components.
- (2) Concentration of solutes from dilute solution.
- (3) Purification of chemical compounds.
- (4) Determination of the homogeneity of chemical substances.
- (5) Control of technical products.
- (6) Determination of molecular structure.

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CHESTER A. HARGREAVES II,
Department of Chemistry, Yale University.

CHROMATOPHORE, krō'mā-tō-fōr, a pigment cell. The possibility of change of color in the chameleon, frog, or the squid, is due to certain cells in the cutis which are filled with pigment. These pigment cells are called chromatophores, and under the stimulus of light may expand or contract. When expanded they are highly ramified and when contracted are roundish. The pigment differs in different individuals and in different parts of the body, being yellow, brown, black and at times even red or green. In the goby (a fish), the chromatophores, which are yellow or greenish-yellow when distended, become orange when contracted; while the orange or red ones, when shrunk, become brown or even black. In the same fish a still different kind of chromatophores are filled with iridescent crystals, which in expansion become visible as spots of metallic sheen. It is on the distribution and different depth in the skin of the chromatophores that the pattern of markings of the skin of changeable animals depend. In the common squid the chromatophores can be seen dilating and contracting, giving off a remarkable play of all the colors of the rainbow. The value of this power, which is under control, is that it gives the animal means of concealment by adapting its color to that of its surroundings.

CHROMATROPE, krō'mā-trōp, or **CHROMOTROPE**, -mō-, a toy consisting of a disc painted with arcs of circles in brilliant colors in such a manner that when the disc is revolved, centrifugal or centripetal streams of color seem to flow through it. The term is also applied to an attachment for a magic lan-

tern, by which, on the revolution of two painted discs of glass, kaleidoscopic effects are projected on the screen.

CHROMATYPE, a photographic picture in which the paper employed has been sensitized by some of the salts of chromium.

CHROME IRON ORE. See **CHROMITE**.

CHROME PIGMENTS. A number of valuable paint pigments are based on lead chromate, $PbCrO_4$, the most important being the following. *Chrome green* is mainly a mixture of lead chromate and the iron ferro- and ferricyanides, which are intensely blue in color. *Chrome yellow* is lead chromate with varying amounts of coprecipitated lead sulphate. *Chrome red*, or *American vermilion*, is a basic lead chromate containing either lead oxide, PbO , or lead hydroxide, $Pb(OH)_2$. The yellow color of lead chromate is modified to paler shades by white lead sulphate. On the other hand, increasing alkalinity shifts the color of lead chromate through orange to a brilliant red. The red pigments, however, are said not to have the covering power of the lighter shades.

Chromium trioxide, Cr_2O_3 , is an ingredient of green ceramic enamels, and, as a paint pigment is called "oil green" or "green cinnabar." Both the oxide and the hydrous oxide, $Cr_2O_3 \cdot 3H_2O$ are used as mordants in the dyeing and printing of textiles.

W. T. READ.

CHROME STEEL. See **CHROMIUM**; **SURGICAL STEELS AND ALLOYS**.

CHROMIC ACID. See **ELECTROPLATING—Chromium**.

CHROMITE, krō'mīt. The only important ore of chromium is chromite, although chromium occurs in a large number of other minerals. Chromite has a theoretical composition of $FeO \cdot Cr_2O_3$, containing 32 per cent FeO and 68 per cent Cr_2O_3 . Chromite is one of a group of isomorphous cubic minerals known as spinels, having the general formula $(Mg, Fe)O \cdot (Cr, Al, Fe)_2O_3$. The natural chromite deposits actually contain varying proportions of alumina, magnesia, lime, and silica, and Cr_2O_3 content varies from less than 30 per cent to more than 60 per cent.

Chromite occurs in a massive form with a granular structure and crystallizes in the isometric system in octahedrons. It is brittle and has an uneven fracture. It is fairly soft compared to other minerals, with a hardness of 5.5. Chromite has a density range of 4.1 to 4.9. Its color varies from dark brown to jet black. It has a luster approaching that of metals, and some chromites are feebly magnetic. The softening point of chromite varies from $2,300^\circ$ to $2,600^\circ F.$, depending on included impurities. It is chemically neutral and almost insoluble in most slags and acids, but its reactivity increases and its refractoriness decreases with increase in iron content.

Chromite deposits are found in ultrabasic rocks or serpentines that have been derived from them. It is often associated with nickel and cobalt, gold, platinum, titaniferous magnetite, magnesite, talc, and chrysotile asbestos.

The three principal uses of chromite are metallurgical, refractory, and chemical. In the United

States, consumption of chromite in 1952 was divided as follows: 57 per cent metallurgical, 33 per cent refractory, and 10 per cent chemical.

Metallurgical use of chromite is for the production of chromium and ferrochromium alloys. (See **CHROMIUM**.) Specifications for chromite for metallurgical use call for a minimum of 48 per cent Cr_2O_3 , and a chromium: iron ratio of 3:1. Silica is undesirable, and combined alumina and magnesia should be under 25 per cent. When ore of these specifications is unavailable, high- and low-grade ores are blended to obtain the most desirable mixture.

Chromite is used extensively for refractory purposes, and most of the ore is manufactured into brick. It is used mainly in basic open-hearth steel furnaces, at and below the slag line, to separate the acid brick of the roof from the basic brick of the hearth. Unlike other refractories, chromite is chemically neutral and resists attack by both acids and bases at high temperatures. In addition to brick, it is used in ramming mixtures for furnace bottoms and as finely ground ore for patching furnace walls. Refractory grade chromite contains about 63 per cent combined Cr_2O_3 and Al_2O_3 . Iron content should be about 10 per cent, and silica about 5 per cent. Iron and silica must be kept low, as refractoriness decreases with increase in iron content, and silicates lower the melting point. Desirable magnesia content is 17 to 18 per cent.

Almost all of the chemical use of chromite is for production of sodium dichromate which in turn is made into various compounds. The largest chemical use is for tanning leather, and the production of pigments. Another important use is for surface treatment of metals. (See **DICHROMATING**.) Chromite and other chromium compounds are used as coloring agents in ceramic glazes and in glassmaking. Chemical grade chromium contains 43 to 45 per cent Cr_2O_3 , and high iron content is accepted within reasonable limits. Silica should be less than 5 per cent. Ore for chemical purposes is used as fines and concentrates to facilitate disintegration during processing.

All of the chromite mined in the United States in 1952, 21,304 short tons, came from many deposits in California and Oregon, although Montana contains the major portion of United States reserves. Chromite occurs also in Washington, Wyoming, Pennsylvania, Maryland, and North Carolina. The Wood mine, in Pennsylvania, was the principal world supply in the early days of the chromite industry.

The major producers of chromite in 1952, in order of production, were Turkey, USSR, Union of South Africa, Philippines, Yugoslavia, New Caledonia, Cuba, Japan, Greece, Sierra Leone, United States, Pakistan, Cyprus. In 1952, the United States imported a record total of 1.7 million short tons of chromite, almost half of the world production, valued at \$38,082,753 of which 54 per cent was metallurgical grade, 35 per cent refractory grade, and 11 per cent chemical grade. The Philippines supplied 32 per cent of the total, Turkey 27 per cent, and Union of South Africa 18 per cent. Chromium ores enter the United States duty-free, but products do not.

ALVIN S. COHAN,
"Journal of Metals."

CHROMIUM, krō'mī-ŭm. The element chromium, a metal, was discovered by Louis

Nicolas Vauquelin in 1797. The name used was a derivative of the Greek *chrōma*, color, because of the variety of colors associated with different chemical compounds of the element. Although Vauquelin worked with red lead ore, which is the mineral crocoite, PbCrO_4 , the only commercially important ore of chromium is chromite, $\text{FeO} \cdot \text{Cr}_2\text{O}_3$.

In producing chromium, chromite ore is first reduced to chromic oxide. The concentrated ore is heated with sodium carbonate to form sodium chromate, and ultimately sodium dichromate. Sodium dichromate is then reduced by sulphur or carbon to form sodium sulphate and chromic oxide, Cr_2O_3 . Chromium metal was first produced commercially from Cr_2O_3 by the Goldschmidt process, or aluminothermic process, by reduction with aluminum. This process is used extensively in the United Kingdom. Chromium metal is produced in the electric furnace by the silicon reduction of chromic oxide, and this method is favored in the United States. Chromium of higher purity is produced by electrolysis from chromic acid solutions. Recently a high purity chromium has been produced economically by electrolysis of solutions containing either chromite or high-carbon ferrochrome. Chromium has been produced on a laboratory or pilot plant scale by many methods including reduction of chromium chloride by magnesium, sodium, or hydrogen; reduction of chromium oxide by carbon, calcium, or hydrogen.

Ferrochromium, an alloy that is the basic vehicle for the addition of chromium to molten iron and steel, is produced in the electric furnace by reducing chromite ore with a carbonaceous agent. Low-carbon ferrochromium is produced by silicon reduction processes in many ways. In one instance, silica under the proper temperature and pressure conditions is used to oxidize and remove carbon from high-carbon ferrochromium.

Chromium plays an important part in the manufacture of alloy or special steels. In steels containing up to 3 per cent chromium, chromium is one of the most commonly used hardening elements. In steels containing 3 to 12 per cent chromium, chromium is used to impart high strength or increased resistance to oxidation at elevated temperatures. Chromium in excess of 12 per cent in steels results in the class known as cutlery steels and stainless steels, characterized by high corrosion resistance. In the group are the important austenitic stainless steels containing nickel in addition to chromium. The 18-8 stainless grades (18 per cent chromium-8 per cent nickel) offer resistance to oxidizing and reducing types of corrosion, and have exceptional physical properties.

Chromium is used with nickel in alloys for electrical resistance elements for heating. It finds important application in high speed cutting tools, refractory metals of the Stellite class, and in alloys developed for high temperature service in jet engines and turbo superchargers. It is also used as an alloying agent in nonferrous alloys of nickel, copper, aluminum, and cobalt.

Chromium plate on steel, in addition to its decorative effect, has the highly desirable properties of corrosion resistance, high hardness, and wear resistance. It has a shiny bluish silvery appearance. It is used extensively in the automotive industry, in the machine tool industry to increase life of working parts, and in the chemical industry to impart corrosion resistance.

Chromizing, a process similar in application to carburizing or calORIZING, is a method of coating steel with chromium to provide oxidation resistance at high temperatures. Low carbon steel parts are packed with a mixture of alumina and chromium powder and heated in a hydrogen atmosphere. A coating of chromium is built up on the steel part by diffusion alloying.

Total consumption of chromium alloys and metal in 1952 was classified as 63.3 per cent used in making steels containing over 10 per cent chromium, 0.4 per cent in high speed steels, 30.3 per cent in other alloy steels, 4.1 per cent in high temperature alloys, and 1.9 per cent in other uses.

Chromium, atomic number 24 in the periodic table of the elements, has an atomic weight of 52.01. It has a density of 7.19 grams per cubic centimeter, and melts at 1890°C . (3430°F). It has a body-centered cubic crystal structure, with other modifications reported. The compounds of chromium are colored, the color changing with change in oxidation state.

The chromous compounds (Cr^{++}) are not common, and blue hydrated chromous ions are oxidized by air or water to the chromic (Cr^{+++}) condition. Chromic compounds are stable and are similar to aluminum compounds. Chromic oxide, Cr_2O_3 , is a green crystalline solid with a high melting point and is used as an abrasive, refractory, pigment, and as a catalyst for certain reactions. Chromic hydroxide, $\text{Cr}(\text{OH})_3$, produced by precipitation from chromic solutions by hydroxide ions or hydrolysis of chromic compounds, is a good mordant and forms brilliant colored lakes with dyestuffs. It is also important in the tanning of leather. Chrome alum, $\text{KCr}(\text{SO}_4)_2 \cdot 12\text{H}_2\text{O}$, is also used in tanning leather. Complex chromic compounds are formed readily and in great variety because of the strong tendency of the triple-charged chromic ion to associate with molecules or other ions. See also ELECTROPLATING—Chromium.

ALVIN S. COHAN,
Editor, "Journal of Metals."

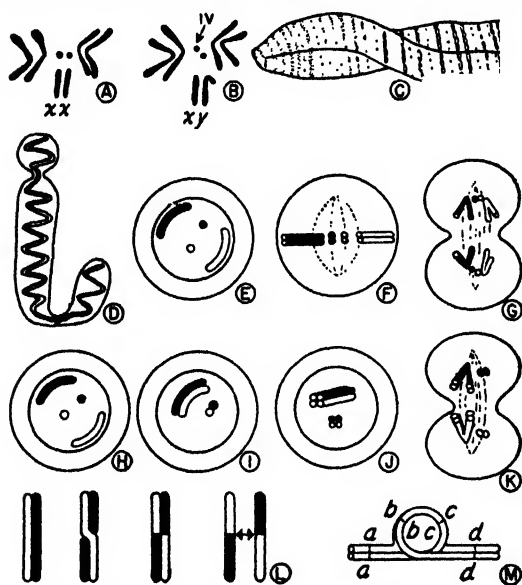
CHROMOLITHOGRAPHY. See LITHOGRAPHY—Chromolithography.

CHROMOSOME, krō'mō-sōm. In 1888 Wilhelm von Waldeyer gave the name chromosome to certain deeply stained bodies in cell nuclei. They are now known to be a characteristic structure in all animal and plant cells. Even bacteria and yeasts have elements of a similar chemical nature. In 1902 Walter S. Sutton formulated the chromosome theory which recognizes that the behavior of the chromosome at reproduction provides the physical basis for Mendel's laws of heredity. Thus the chromosomes are of great significance to living beings, for they act as the carriers of the units of heredity, the genes.

Chromosomes are chemically and structurally complex. They are composed primarily of nucleic acids and proteins (chromatin) which absorb strongly certain wave lengths of ultra-violet radiation. They color intensely with a variety of stains, one of which, the Feulgen stain, is relatively specific for chromatin. During the various phases of cell division they undergo extensive alterations of shape which are interpreted as involving changes in water content. At the metaphase stage of cell division when the chromosomes are in their most compact form they com-

monly have the structural features shown in (D). The main body of the chromosome constitutes the matrix; within the matrix is a double-stranded coil, the chromonema; a primary constriction bears a kinetochore or spindle attachment granule; other constrictions may be present.

Every species has a fixed number of chromosomes, each one characteristic as to shape and relative size, see (A). Commonly sperm and egg cells contain one of each kind and are said to be haploid. After fertilization, the sperm and egg chromosomes are combined in a single nucleus, producing a diploid cell which has two of each kind. Each chromosome passes through a cycle of duplication at the time of cell division, or mitosis. (See CELL—Cell Division.) In the non-dividing cell they are elongate filaments which



(A) chromosomes of *Drosophila melanogaster*, a somatic metaphase in the female; (B) same in male *Drosophila*, chromosome IV at the arrow; (C) paired IV chromosomes of *Drosophila* salivary gland (after Bridges); (D) diagram of a metaphase chromosome showing matrix, chromonema, primary constriction bearing kinetochore and secondary constriction; (E) (F) (G) prophase, metaphase, and anaphase of somatic mitosis; (H) through (K) stages in the first meiosis; (H) is before pairing; (I) is the pairing stage, synapsis; (J) is the diplotene; and (K) is one possible pattern of the anaphase of the reduction division; (L) diagrams of the process of crossing over which occurs during synapsis; (M) pairing between a normal chromosome with genes in the order *a, b, c, d* and a chromosome with an inverted segment with genes in the order *a, b, c, d*.

shorten progressively during the prophase, the early stages of division, see (E). In the following stage, metaphase, see (F), they become compact bodies which color intensely in the killed and stained cell or stand out in strong contrast in the phase microscope. Each metaphase chromosome is composed of two halves, presumably parent and replica, so that when the halves separate in the anaphase, see (G), each daughter cell gets an identical chromosome set and a complete set of genes. The significant feature of mitosis is this precise replication of each chromosome which insures that all of the descendant cells shall have the same heredity, at least as regards nuclear genes.

The behavior of the chromosomes is different during the two divisions of meiosis than it is in

the ordinary mitosis described above. Meiosis occurs during gamete formation in most animals and during spore formation in most plants. The end result of the process is to produce haploid cells from diploid cells. During the prophase of the first meiotic division the chromosomes unite in pairs (synapsis) as shown in I, an event which prepares the way for the reduction in chromosome number. Pairing is a special feature of meiosis; it occurs only rarely in somatic cells. The second meiotic division resembles, in many respects, a somatic mitosis as already described. The details of the meiotic process are too varied and too detailed to be fully recorded in this place. It should be noted, however, that meiosis with its consequent reduction of the chromosome number to one half of the species number, is the logical complement of the process of fertilization which restores the diploid number.

The evidence that genes are carried on the chromosomes "like beads on a string" is extensive and compelling. Cytogenetic research which combines the study of chromosomes with breeding experiments has demonstrated that an exchange of segments often takes place between the paired chromosomes at synapsis. This phenomenon is called crossing over, and it is associated with corresponding changes in the inheritance of the genes involved in the crossover, see (L). Genetic studies of crossing over make possible the mapping of the position of genes on the chromosome. Chromosomes are broken by various means including X-radiation and treatment with chemicals. The detached pieces may recombine with the same or with other chromosomes, forming new gene associations (inversions, translocation) or the piece may be lost (deletions). Either abnormality produces aberrant hereditary types.

In some cells the chromosomes and their containing nuclei become extraordinarily large, as for example in the salivary glands of the fruit fly *Drosophila*. In these cells the nuclei are relatively enormous, the chromosomes are paired and are fortunately marked with transverse bands, C, so that it has been possible to identify the location of many genes with a considerable degree of exactitude. The two paired members are quite precisely joined so that band for band they correspond throughout their length. The forces which bring about the exact pairing of chromosomes are at present unknown. One of the best proofs of the linear order of the genes arises from the pairing figures which occur when a normal chromosome pairs with one which has an inverted segment as shown in M.

It has been demonstrated in many species of plants and animals including man that the sex of the individual is determined at fertilization. In the fruit fly, *Drosophila*, and in man, the sexes differ as regards one pair of chromosomes, see (A) and (B). The female has two x chromosomes; the male has an x and a y. Two different kinds of sperm are formed at the reduction division, x-bearing or y-bearing, and they are formed in equal numbers. In these species all mature eggs contain one x chromosome. A male results if a y-bearing sperm fertilizes any egg. A female results if an x-bearing sperm fertilizes any egg. The final differentiation of sex during the development of vertebrate animals is conditioned by endocrine factors.

Consult Wilson, E. B., *The Cell in Development and Heredity*, 3d ed. (New York 1925); White, M. J. D., *The Chromosomes* 2nd ed. (The Chromosomes, Methuen, London 1942); deRobertis, Eduardo D. P., and others,

General Cytology, tr. by Warren Andrew Saunders (Philadelphia 1949).

ALLAN SCOTT,
Chairman, Biology Department, Colby College.

CHROMOSPHERE, *krō'mō-sfēr*, the second layer of the so-called atmosphere of the Sun. The true surface of the latter, which is what we actually see when we view the Sun—the atmospheric layers being transparent to the eye—is called the photosphere. Above it, in order, are the reversing layer, the chromosphere, and the corona. As even the main body of the Sun is gaseous, it must be understood that there cannot be any sharp division between the above-mentioned layers, such as between the Earth's surface and the air above it. Though the boundaries are somewhat indefinite, still each layer mentioned has inherent properties and it is quite proper to speak of them as actually distinct. The solar radius is about 432,000 miles; the reversing layer is generally considered to have a thickness of less than 200 miles; the chromosphere is perhaps 10,000 miles thick. The inner corona reaches out fully 200,000 miles, and the streamers of the outer corona stretch out to many million miles in some cases.

The first reference to what may be considered chromospheric phenomena, namely prominences, seems to have been in 1706, but the first quite complete account was not given until 1846, both of course during total solar eclipses. The first profitable study of such phenomena, using spectroscopic means, was made by Jules Janssen at the eclipse of 1868 and shortly thereafter by Joseph N. Lockyer, without an eclipse. At the Spanish eclipse of 1870, Charles A. Young of Princeton first fully observed the so-called flash spectrum, which permits an analysis not only of what elements are present but also gives the means for determining their abundance and how high each extends above the solar surface.

It is practically impossible, for our purposes, wholly to separate the reversing layer and the chromosphere; indeed the former is from many standpoints merely the lower and denser part of the latter. Hence the flash spectrum refers to both. However, to make the discussion intelligible, something must be said about the spectroscopy and how it is employed in such work. If we photograph the spectrum of the Sun we find a continuous background running from violet to red, crossed by many thousand dark lines. These latter are caused by absorption in the reversing layer. But at total eclipses, just when the Moon's disk has wholly covered the Sun, part of the solar atmosphere becomes visible for a moment as the main body of the Sun is shut out. To the eye this would appear scarlet, because of the hydrogen, but what first called attention to it were scarlet protuberances which went out for some distance and often resembled tongues of flame. These are now called prominences and may be seen at every total eclipse. They were so brilliant at the Indian eclipse of 1868 that Janssen believed he could see them in full daylight. The principle is this: we do not see them on any clear day simply because our atmosphere is too bright close to the Sun. But the spectroscope, as dispersion is increased, makes the continuous solar spectrum longer and hence fainter per unit area. However, as the prominences consist of only a few gases and their light is concentrated in characteristic bright lines, more dispersion

merely sets these lines further apart without making them fainter. A time will come evidently when the lines will be brighter than the background. So by opening his slit somewhat, Janssen was able to detect the prominences in full sunlight. Lockyer, in England and wholly independently, hit on the same idea two months later. From that time on, prominences could be observed without eclipses. As to the chromosphere itself, its chief constituents are hydrogen, helium, and ionized calcium. It is true many other elements are also found, especially at lower levels, but those mentioned are most characteristic. The pressure is unbelievably low, being estimated at one ten-millionth of an atmosphere at the lower level, and 1,000 times less near the upper. One may wonder why calcium, a rather heavy element, is so conspicuous, but in its ionized state it is particularly susceptible to radiation pressure, and it is believed that the latter holds it up against solar gravitation, which is 28 times as great as at the Earth's surface.

The work of Young in 1870 proved that, once the Sun's disk was covered, the lines caused by the chromosphere instantly appeared bright and coincided in position with the dark lines seen in the usual spectrum. The next great advance was made by Henri Deslandres of France and George E. Hale in America, each inventing independently about 1890 what is now called the spectroheliograph. The principle involved here is the same one used in getting a spectrum of the Sun with a spectroscope. But just in front of the photographic plate a metal plate is fixed which contains a narrow slit. This plate can be displaced laterally until the second slit comes to any given line in the solar spectrum. Always one of the wider or more prominent lines is chosen, such as C of hydrogen or H or K of ionized calcium. With high dispersion these lines have an appreciable width. Hence if the second slit is made very narrow, the center of a given line, its edge, or halfway between may be isolated and photographed. From well-known principles, light from the edges comes from the lowest level visible, the center from the highest level, and the intermediate position from perhaps halfway up in the chromosphere. Then by having a slit long enough to reach across the solar disk, and by slowing the telescope's driving clock slightly, one can photograph the solar atmosphere all across the Sun, not only in light of one element but also at three different levels showing the distribution of the element in question. In this way superb photographs are obtained showing the distribution of the elements at various levels.

The prominences used to be simply divided into quiescent and eruptive, but now sharper designations are needed in technical discussions. The simpler are adequate for our purposes. Quiescent are generally larger than eruptive prominences, move more slowly, and have a wider distribution over the disk. They are largely made up of the three main chromospheric elements. The eruptive are frequently found in the sunspot zones, they also show many other elements in their constitution, and their shapes change rapidly. A few have been seen to rise almost to a solar radius, the record being 1.22 radii, and their radial velocities can attain many hundreds of kilometers per second. The latter record is 750 kilometers per second. Their shapes and behavior are most varied. As undoubtedly some

are cooler than the background, they show up on the spectroheliograms as fantastic dark shapes some of which resemble earthworms.

In recent years it has been possible to secure moving pictures of prominences and what one sees is, in some cases, almost unbelievable. Frequently the prominences move out from the solar surface in curves which strongly resemble magnetic lines of force and so continue until they return, thus completing the curve. For others the material seems to go out for some distance beyond the highest point of the arch and then, instead of going forward, seems to reverse its direction and go backward. Again we see in a region above the solar surface, which seems utterly devoid of material, a formation suddenly appear and the material pours down. Others resemble geysers or ornamental fountains in their behavior. If one takes a single exposure on some of the more fantastic shapes they strongly resemble the skeletons of prehistoric monsters or giant birds. Two other phenomena known as flares and spicules must be mentioned. The former consist of a sudden brightening of part of a bright flocculus near a sunspot. In hydrogen light, in a very few minutes, this becomes quite the most brilliant point on the Sun. They rarely last but a few hours and generally subside very rapidly, the surrounding area showing little effect of what happened. They are intimately connected with fadeouts in short-wave radio transmission. The latter is probably caused by an excess of ultra-violet radiation from the flare which ionizes our upper atmosphere. The spicules are sharp, small, and bright and are seen all over the Sun, even in the polar regions where spots never occur and many other phenomena are uncommon. The brightest go up about 4,000 miles and rarely last more than 10 minutes. There must be vast numbers on the Sun at any given moment.

Some of the most curious results of solar research are concerned with temperatures. For some decades scientists have agreed that the photospheric temperature is about 6000°K. (absolute centigrade degrees). But it was naturally thought that temperatures in the upper layers of the solar atmosphere would be lower. Remarkable work on the identification of lines in the solar corona with metallic gases which had undergone multiple ionizations of a high order first indicated the temperature there as of the order of a million degrees centigrade. More recent work on the chromosphere indicates that high temperatures are also found there. It is true that results from the three highly technical methods used do not agree well, in fact running from 30,000°C. to 175,000°C., but the significant thing is that all agree in giving a temperature vastly higher than the photospheric temperature. Both a description of the methods used and the tentative explanations of the values derived are wholly out of the scope of a general descriptive article. In fact, while more and more information about the Sun is being found and while acceptable theories for the maintenance of its radiation are now at hand, anything like complete or satisfactory theories as to what goes on beneath the photosphere, causing sunspots and other phenomena, and much of what goes on above it, some of which has just been briefly described, still remain to be formulated.

Consult Mitchell, S. A., *Eclipses of the Sun*, 5th ed. (New York 1951); also any general astronomy published

since 1945. Advance in solar research has been so rapid that practically all older works are out of date. *Transactions* of the International Astronomical Union contain résumés of all recent work. Technical journals on astronomy have much on the Sun.

CHARLES P. OLIVIER,

Director, Flower and Cook Observatories, University of Pennsylvania.

CHRONICLE, krōn'ī-k'l, a history recounting in order of time all details which observation or tradition has furnished the author. It may be a universal history, or may deal with a single epoch, nation, city, or individual. Some chronicles have been preserved from early ages. The Old Testament Chronicles are a type of such.

In the early Christian ages, ecclesiastics were generally the authors of the chronicles. Most of the medieval chronicles were by monks who usually began their story with the Creation, followed by an abridged history of events from the first chapter of Genesis to the immediate subject of their narrative. They usually did not distinguish fact from fiction, were not inclined to question much either visions or miracles, and were accustomed to dwell as long on unimportant as on momentous events. Chronicles are valuable for determining historical facts when they contain materials from older works which are now lost, or when they relate events contemporary with a writer, and of which he was a witness; and they are always valuable as an illustration of the spirit of an age and the sentiments of a people. It is through them that nearly all the history of the Middle Ages has been preserved. Every European people has numerous medieval chronicles.

France is rich in chronicles written in Latin, French, and various provincial dialects. The first of the chroniclers who wrote in the popular language of France was Geoffroi de Villehardouin who lived in the 12th century and was an actor in the events which he describes. Froissart's *Chronicles* (q.v.) embrace the events occurring from 1325 to 1400 in England, Scotland, France, Spain, Brittany, and the Low Countries, setting forth in detail the feasts, spectacles, and all the pageantry of feudal times, and enlivened throughout by Froissart's shrewd observations.

Of the strictly English chronicles, the *Historia Regum Britanniae* by Geoffrey of Monmouth, a monk of the 12th century, is of particular interest because it tells of King Arthur more fully than any previous work. Geoffrey also traced the history of Britain through a series of imaginary kings from Brutus, a son of the Trojan Aeneas, who founded the British state many centuries before the Christian era, to Cadwaladr Vendigaid who probably died in 664 A.D. There is also the *Anglo-Saxon Chronicle*, extending from the beginning of the Christian era to the death of King Stephen in 1154. (See **ANGLO-SAXON LANGUAGE AND LITERATURE**.) The collection of chronicles edited by Raphael Holinshed from 1573 to 1578 and published in the latter year embraces a history of England up to 1575, a history and description of Ireland by Richard Stanyhurst, and a history of Scotland by Hector Boece. *The Chronicle of the Kings of England* by Sir Richard Baker, published in 1643, is a history of England from Roman times to the death of King James I.

CHRONICLES, Books of. The books of Chronicles were originally one book in the Hebrew, which is also true of Ezra and Nehe-

miah. Further, it is now a generally accepted conclusion that these two books, Chronicles, and Ezra and Nehemiah, were written by the same author and were, when composed, a single work. The reasons for this conclusion are the following:

Ezra is the direct historical continuation of Chronicles. Further, two verses at the end of Chronicles are repeated at the beginning of Ezra, a duplication which is supposed to have occurred when the division was made. Also, the characteristics of both works are the same. These are particularly a fondness for genealogies and also for the treatment of religious matters, especially those things which pertain to the temple and the work of the priests and Levites. Again, both are marked by the same unusual late linguistic peculiarities.

In Chronicles the passage which apparently indicates the latest date is I Chron. 3:19-24, where the sixth generation after Zerubbabel in the line of David is mentioned, which would be about 350 B.C. The text of the passage is, however, somewhat doubtful; the Septuagint reading indicates the 11th generation. Nehemiah contains clearer evidence of a late date. The high priest Jaddua, of the time of Alexander the Great, is mentioned, Nehemiah 4:10f, 22f. Further, the description of Darius as the Persian, Nehemiah 12:22, would be unnecessary and unnatural while the Persian empire was in existence, and implies that at the time of the writer that empire belonged to the past. Hence the writer lived probably about 300 B.C., but possibly later than that.

I Chronicles 1:9 contains the history of the Hebrews from Adam to Saul; 10-II Chron. 9, the history from the death of Saul to the death of Solomon; II Chron. 10:36, the history of Judah only, without Israel, to the end of the Babylonian captivity in 537. When this history is compared with the parallel accounts in the books of Samuel and Kings it shows many omissions and also many additions. The omission of the entire history of the northern kingdom, Israel, is specially notable. The whole of the material of II Sam. 9:20, except the account of the wars with the Ammonites, is omitted. This is particularly significant because the omitted portion gives an account of the failings of David and the unfavorable side of his court and family life. The additions are concerned chiefly with the activity of the Levites and the prominence of the temple and ritual matters. An example of a long addition is I Chron. 22, II Chron. 29, 30, of which only 29, 23a, 27, is from a known source, i.e., from I Kings. The additions show an idealized view of the history, representing the P code as in force in the time of David.

It is evident that the sources used by the writer included some of the canonical books, principally the books of Samuel and Kings, with the Pentateuch and Joshua employed less extensively. The material from these canonical books is largely in the form of verbatim extracts, with omissions and additions, but not rewritten. The author also refers to other sources under at least 15 titles, such as: The Book of the Kings of Judah and Israel, II Chron. 16:11; The Book of the Kings of Israel and Judah, II Chron. 27:7; The Midrash of the Book of the Kings, II Chron. 24:27. It is obvious that several of the titles refer to the same work, and that is possibly the case with all. The principal source

used by the writer, then, aside from the canonical books, is a work covering the history of Israel and Judah; whether any other sources are referred to is uncertain. It is probable that the material from the extra-canonical source or sources is rewritten. At any rate, the portions not drawn from the canonical books all have the same peculiar late style.

The historical value of the portions of Chronicles not derived from the canonical books is uncertain. Much of the material is distinctly improbable, some being quite out of harmony with the earlier material from the canonical books. On the other hand, it cannot be asserted that there is no historical element in this added material. The evidence is not sufficient to afford a positive judgment in every case. The religious standpoint of the book is that of the time of the writer, and he puts that standpoint into the earlier time. The historical value of the book is largely that of showing the religious standpoint of about 300 B.C.

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GEORGE R. BERRY,
Professor of Old Testament Interpretation and
Semitic Languages, Colgate University.

CHRONICLES OF CLOVERNOOK, a story by Douglas Jerrold, published in 1846. Clovernook is a "hamlet wherein fancy has loitered away a truant hour"; and under the guidance of the "Hermit of Bellyfulle" the author explores Clovernook, and discourses of it. The book charms by its quiet humor, the grace of its fancy and the benevolence which characterizes even its satire.

CHRONICLES OF FROISSART. See CHRONICLE.

CHRONICLES OF THE CANONGATE, a collection of Sir Walter Scott's stories published in two series. The first series (1827) contains *The Highland Widow*, *Two Drovers*, and *The Surgeon's Daughter*; the second series (1828) contains *The Fair Maid of Perth*.

CHRONICLES OF THE SCHONBERG-COTTA, shen'berg-kót'tä, **FAMILY**, a novel by Mrs. Elizabeth Charles, published in 1863. It is the story of a family during the period of the Reformation in Germany, as told chiefly by Friedrich and Else, the oldest children. The book is written with an effort after the archaic style, and has much of the simplicity and directness of the old chronicles. It is interesting and has proved a great favorite, though accurate scholarship finds fault with its history.

CHRONOGRAM, a device by which a date is given in Roman numerals by printing certain letters of an inscription larger than the others; as in a motto of a medal struck by Gustavus Adolphus in 1632: ChristVs: DVX; ergo

trIVMphVs. The value of C and the other capitals equals 1632, MDCXVVVII.

CHRONOGRAPH, a device for obtaining a permanent record of the time of an event. The existence of this record distinguishes the chronograph from other devices—such as the stop watch—that are used for determining the times of events. Moreover, the times determined by the chronograph are referred to a clock, and have a certain absolute significance depending on how well the correction to the reference clock is known on an accepted standard of time. This feature distinguishes the chronograph from the chronoscope which is used when it is a question of measuring small intervals of time.

Generally the chronograph itself is not a clock, but only serves as an intermediary between some standard of time and the event to be timed. The development of the crystal-controlled oscillator as a source of constant frequency to run a small synchronous motor has led, however, to a type of chronograph that may itself serve as a clock. This results in a more direct determination of the time of an event and eliminates such error as may arise from the non-linearity of the time scale provided by the chronograph acting as an intermediary. However the use of the chronograph as a clock is dependent on the availability of a source of constant frequency, so that the older types such as the writing chronograph are still much used.

The simplest form of writing chronograph is the drum chronograph. In this device a record is made on a sheet of paper fastened around a cylindrical drum. A weight driven clockwork rotates the drum about its axis, which is horizontal. The rate of rotation is controlled by a governor, which is adjusted to cause the drum to rotate once every minute or half minute. A small carriage carrying an electromagnet and pen holder, forming part of the armature, is driven along ways parallel to the drum by a screw; each rotation of the drum moves the carriage forward about one twelfth of an inch, the pen thus describing a spiral on the drum. The electromagnet is connected in a circuit with the standard clock so that every second, or every other second, the circuit is closed momentarily through a contact in the clock. Thus the electromagnet pulls the armature to it in opposition to a small spring, the pen making a jog in the line it is tracing on the paper wrapped around the drum. If the event to be timed is made to similarly produce a record, the time of its occurrence may be estimated by interpolating the time of the jog made by the event among the jogs made by the standard clock. A scale with the length of the interval between successive seconds, as indicated by the standard clock, as a unit facilitates the interpolation. By having the standard clock omit the recording of a particular second of each minute and observing the time of starting the chronograph, the signals recorded by the clock may be identified. If a sufficiently accurate source of alternating current is available, a synchronous motor may be substituted for the weight driven clockwork, resulting in greater uniformity of rotation.

Another form of the writing chronograph records on a tape. In this type a ribbon of paper is pulled uniformly past the pen, which is stationary. The jogs are recorded as before and the time of any jog is read with a scale. This type

of chronograph permits a small section of record to be examined without the necessity of stopping the chronograph and removing the entire record as with the drum chronograph. Either of these chronographs permit the time of an event to be estimated with an accuracy of one one-hundredth of a second.

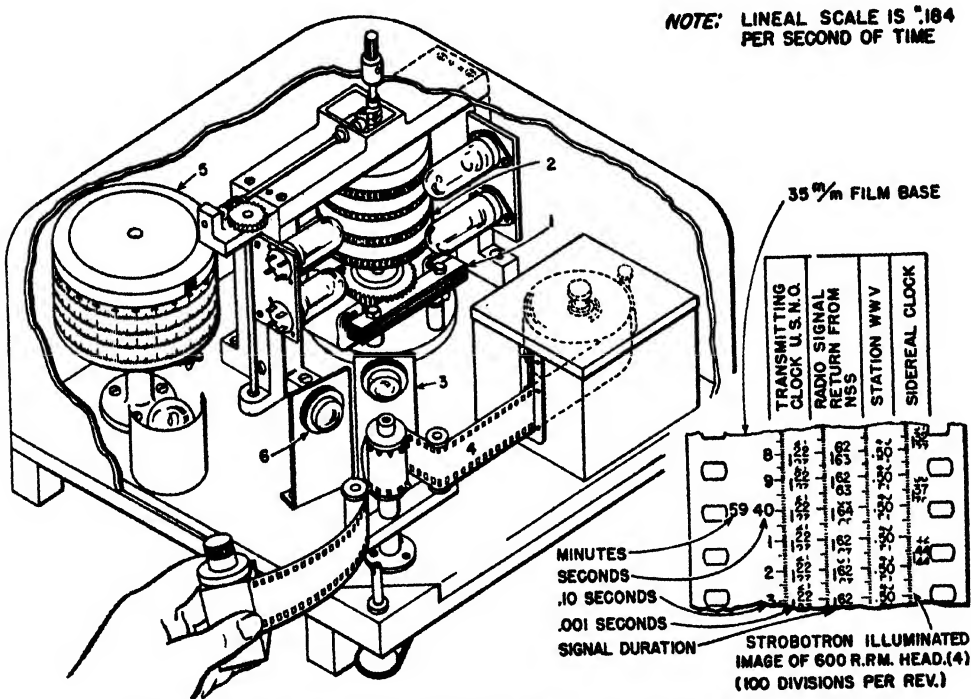
A form of chronograph invented by George Washington Hough prints the time of an event directly to the hundredths of a second. A paper tape is drawn past three printing wheels having engraved on their peripheries numbers corresponding to minutes, seconds and hundredths of a second, respectively. The tape is passed between these wheels and a set of hammers attached to the armature of an electromagnet. Whenever the circuit through the electromagnet is completed, the hammers press the tape momentarily against the wheels and the time is printed on the tape, which is then pulled forward to leave space for the next printing. The accuracy of this chronograph is dependent on its regulation by the standard clock. The wheel marking hundredths of a second is not fastened directly to the clockwork of the chronograph, but is constrained to move with the clockwork by a pawl rigidly attached to the shaft on which the hundredths wheel is mounted and engaging one of a hundred teeth on a wheel turned by the clockwork. At each rotation this pawl passes under an electromagnet that may be energized by the standard clock, except for an instant at the beginning of each second. Hence if the pawl arrives under the electromagnet before the beginning of any second, it will be disengaged from the toothed wheel and the printing wheel held up until the pawl is released at the start of the next second. If the governor on the chronograph is set so that the toothed wheel is driven slightly fast, this regulating action will take place each second that the electromagnet is energized. In practice the electromagnet is energized every fourth second and the governor is carefully adjusted so that the corrections do not exceed one or two hundredths of a second. The wheel for printing seconds is caused by a pawl to advance one unit with each revolution of the hundredths wheel. The minutes wheel is similarly advanced one unit with each revolution of the seconds wheel. By causing the standard clock to print a record, the chronograph may be set at the beginning of a run so that the time printed will be that indicated by the standard clock.

A form of printing chronograph designed and constructed at the United States Naval Observatory permits the simultaneous intercomparison of eight independent series of signals. In this chronograph a paper tape is fed between a set of eight rollers and printing wheels opposing the rollers. The printing wheels are mounted end to end along the same shaft and spaced about one quarter inch apart. Each wheel is three quarters of an inch long and the same in diameter; a series of 20 raised dashes forms a spiral around each printing wheel, each dash is about one twelfth of an inch long. These wheels are rotated 10 times a second by a constant speed motor operating off commercial current. The paper is fed past the wheels at a rate that moves it forward a little more than the length of a dash in a tenth of a second thus the wheels print 10 columns of dashes on the paper each second, each dash representing 0.005 seconds. In practice the rollers opposing the printing wheels

are held at a distance of about 0.01 of an inch by small electromagnets acting against springs, so that an impression is made on the paper tape only during the time that the circuit through the electromagnet is open. Since the circuit to each electromagnet is held open for only a few tenths of a second, each second by a clock, the record for each clock will be a series of impressions; each impression consisting of two or three columns of dashes. If two clocks are in agreement corresponding impressions will start with the same dash. If one clock lags behind the other the difference in time is the difference in dashes multiplied by 0.005 seconds. By reading a number of impressions, two clocks may be compared with an accuracy of about 0.002 seconds. Provision is made to have one clock operate all the magnets simultaneously, so that they may be adjusted to start an impression with the

an image of one or two numbers on the disc. At the same time four scales divided into seconds and tenths, are projected on the film by another lens (6) from a rotating drum (5). By this means, current interruption occurring in four different circuits may be timed simultaneously. These interruptions are indicated by lines appearing alongside the time scales, and the times of the beginnings of these interruptions are read to the nearest tenth of a second by the scales, while the hundredths and thousandths of the second are indicated by the figures. Since the strobotron flashes endure for less than a ten-thousandth of a second, the numbers are photographed without blurring.

A spark chronograph developed at the Loomis Laboratories, Tuxedo Park, N.Y., affords a means of intercomparing continuously the rates of two or more clocks. As originally constructed



Photographic chronograph constructed and used at the United States Naval Observatory.

same dash when actuated at the same time. The dashes are arranged on the printing wheel so that a printed column of 20 is broken into groups of four to permit easy identification of corresponding dashes and counting.

A photographic chronograph constructed* at the United States Naval Observatory is driven by a thousand cycle subsynchronous motor (1 in illustration) which is controlled by a quartz crystal oscillator, insuring high accuracy. The rotor of the motor carries four discs (2), each graduated from 00 to 99. Since the rate of rotation is ten revolutions per second, the figures correspond to thousandths of seconds. Four strobotron lamps are provided, one to illuminate each scale. A system of shields, not shown in the drawing, prevents each lamp from illuminating more than one of the discs. When any lamp flashes a lens (3) projects on to 35 mm. film (4)

the record is made on a prepared paper tape run between a comb of one hundred equally spaced phonograph needles and a grounded metal bar. Each of the one hundred needles in the comb has its counterpart in a circle of one hundred needles surrounding a rotating disc carrying a single needle. This disc is caused to rotate 10 times a second by a synchronous motor operated by a crystal-controlled oscillator. The ticks from a clock to be compared with this standard actuate a relay and complete a circuit between the rotating needle and that one of the set of one hundred surrounding the distributor that is nearest it at the time of the tick. This needle is charged to a high potential, causing a spark to pass from the corresponding needle in the comb to the metal ground beneath the paper, the spark producing a small hole in the paper. If the second clock has the same rate as the standard, it will always

charge the same needle in the comb and a row of holes will be formed parallel to the edge of the paper. If the rate differs, progressively different needles will be charged and the row of holes will have a slope relative to the edge of the paper, the amount of the slope being a measure of the relative rates of the clocks. If several clocks are compared simultaneously the relative rate of any two is measured by the angle between the lines formed by each. A difference in rate of 0.001 seconds a day between two clocks is easily detected by this device.

HARRY M. BENDLER,
United States Naval Observatory.

CHRONOLOGY, the science of dating which arranges time into periods or divisions and attempts to assign precise dates to events within those periods. Exactness in history depends upon exactness in chronology. Events of one nation cannot be correctly integrated with those of another until a correct chronology has been established for both. The attainment of absolute correctness is the goal of those who would make history an exact science and the goal is nowhere in sight at present. New evidence is constantly being introduced and revisions are made accordingly; the chronologies of one generation are likely to be unacceptable to the next. Advances made in our knowledge in a little over a century are breathtaking when one considers that at the beginning of the reign of Queen Victoria, Archbishop Ussher's date of 4004 B.C. for the creation of the world was still accepted. This article can do no better than serve the reader as a guide to latest authoritative findings.

First awareness of recurrent phenomena marking divisions of time came from simple observations of nature. Earliest divisions of the year were probably not according to four seasons, but to two—heat and cold. The year began with the awakening of spring and closed with the onset of winter. The winter months were a wretched hiatus in the year's round of the primitive farmer.

Division of the year into four seasons is based upon observations of positions of stars or constellations. One of the oldest of existing farmers' calendars, Hesiod's *Works and Days*, prescribes plowing and sowing operations according to the rising and setting of constellations. Aside from the need for observing the proper time for agricultural operations, religion required the close observation of recurring celestial phenomena. Failure to observe the right day for a ceremony would result in the displeasure of the gods. So formal reckoning of time and the development of calendars came into the hands of the priest class. Calendars all over the world began as cycles of religious feasts. Feast and fast days observed in religious calendars today are a surviving feature from earliest calendars.

These are matters of prehistory that more properly belong in the scope of the archaeologist and anthropologist. When we come to historical times we are surprised to find how difficult it is to establish chronologies in the early period, even in countries like Egypt and Babylonia, where abundant records have survived and where careful observations of celestial phenomena were made.

Egyptian Chronology.—Most dates are approximate, and before 2000 B.C. are given in round numbers. In the early period Egyptians

dated by outstanding events associated with the reign of a pharaoh, such as "the year of smiting the northerners"; later they used the more precise system of reckoning according to regnal years, such as "the twelfth year of Senwosret III." In the absence of complete king-lists it is impossible to establish an exact chronology. Partial lists have been found: the *Turin Papyrus* (c.1200 B.C.); the *Palermo Stone* (c.2600 B.C.); the Royal Lists of Abydos, Karnak, and Sak-kara; and the *Aegyptiaca* of Manetho. Manetho was an Egyptian high priest who about 280 B.C. wrote a history of Egypt in Greek from earliest times to 323 B.C. He had access to complete king-lists and detailed records, but unfortunately his work is fragmentary. He set up a system of arranging all Egyptian rulers, from the first historical king Menes to Alexander the Great, into 30 dynasties, with larger divisions of Old, Middle, and New Kingdoms. This system is still in use today.

Other bases for Egyptian chronology are records of synchronous events and astronomical observations. The Amarna Letters (q.v.) and the Boğazköy records have provided numerous synchronisms between kings of Egypt and Babylonian, Assyrian, and Hittite chronologies. Egyptians, from very early times, celebrated the heliacal rising of Sirius with a feast, because this was the harbinger of the annual flooding of the Nile. Upon this event they established their calendar of 365 days, divided into 12 months of 30 days each, with 5 feast days at the end of the year. Every 4 years the calendar was 1 day short and every 1460 years it righted itself. Such a period was called a Sothis-period from their name for Sirius. This discrepancy was known to them, and in 238 B.C. a reform was proposed in the Decree of Canopus by which a day was to be inserted every fourth year. This proposal was to become the basis for the reformed Julian Calendar of Julius Caesar. One cycle is supposed by some to have ended in 139 or 143 B.C., and by calculating from the beginning of this Sothis-period the accession of Amenhotep I would be dated at 1553 or 1557 B.C.

The Borchardt-Edgerton chronology (1935-1937) given here differs little from those of Breasted and Eduard Meyer, who place the Old Kingdom slightly earlier. The chronology of Flinders Petrie is no longer widely accepted.

PREDYNASTIC PERIOD: Before 320' B.C.

PROTODYNASTIC PERIOD: 3200-2800 B.C. Dynasties I-II. OLD KINGDOM: 2800-2250 B.C. Pyramid Age. Dynasties III-VI.

FIRST INTERMEDIATE PERIOD: 2250-2000 B.C. Collapse of Old Kingdom. Dynasties VII-XI.

MIDDLE KINGDOM: 2000-1780 B.C. Dynasty XII.

SECOND INTERMEDIATE PERIOD: 1780-1546 B.C. Dynasties XIII-XVII.

NEW KINGDOM: 1546-1085 B.C. Dynasties XVIII-XX.

THE DECLINE: 1085-332 B.C. Dynasties XXI-XXX, ending with conquest of Egypt by Alexander the Great.

Early Babylonian.—Chronology of Sumerian and Akkadian dynasties is usually based upon estimated dates of Hammurabi's reign. Around this time greater reliance can be placed upon synchronisms and records of astronomical observations. By working backwards through existing king-lists it is possible to set up a system of earlier Babylonian dynasties whose dating is at best roughly approximate.

The early Kish and Uruk dynasties of the king-lists are now referred to the first half of the third millennium B.C., a period called *Early Dynastic*. The king-lists become more reliable

when we reach the *1st Dynasty of Ur*, beginning with the reign of Mes-anne-pada (c.2525 B.C.). This is the dynasty of the Royal Tombs of Ur and is said to have lasted 177 years. It ruled over most of Babylonia. The next ruler to enjoy wide hegemony was Lugal-zaggisi (c.2289-2264). He was defeated by Sargon I, an Akkadian, about 2264. Sargon ruled at Agade (c.2277-2221). His grandson, Naram-sin (c.2197-2160), attained to still greater glory and domain. An invasion of a barbarian horde of Gutis followed a brief period of anarchy and, after about 90 years, the Gutis were driven from Babylonia by the king of Uruk (c.2060). Then came the *3d Dynasty of Ur* (c.2053-1944), under which Sumerian culture reached its highest development. After a period of rival dynasties of mixed rulers at Isin and Larsa, the *1st Dynasty of Babylon* was established, whose sixth king, Hammurabi (c.1728-1686), brought the early Babylonian empire to its greatest glory. It soon crumbled before a Kassite subjugation (c. 1677) which was to last intermittently for over five centuries.

Minoan Chronology.—Sir Arthur Evans set up the system which has long been standard for Aegean chronology by basing his scheme upon synchronisms with Egypt according to the Egyptian dating in Eduard Meyer's *Aegyptische Chronologie*. It now appears that Evans' estimate of 1300 years of early bronze age culture in his Early Minoan I-III period was too great. A revised chronology incorporating an average between two recent archaeological estimates of Early Minoan dating follows:

Early Minoan I	2000-2600 B.C.
Early Minoan II	2600-2350
Early Minoan III	2350-2100
Middle Minoan I	2100-1900
Middle Minoan II	1900-1700
Middle Minoan III	1700-1550
Late Minoan I	1550-1450
Late Minoan II	1450-1375
Late Minoan III	1375-1100

Assyrian Chronology.—This is founded upon abundant sources of information which are for the most part corroborative. As a result the period from 911 to 626 B.C. is established with possible discrepancies amounting to one year in some reigns. From 911 to 1068 B.C. the margin of error may be as much as ten years, and beyond the latter date the possibility of error increases. Among the important sources are the so-called *limnu* lists for the years 890-648 B.C., which are tables of archons whose years of office were designated by their names. Lists of Assyrian kings covering the period from the 24th century to 746 B.C. were found in the palace of Sargon II at Khorsabad. The *Synchronous History* records relations between Assyria and Babylonia for eight centuries preceding 800 B.C. The *Gadd Chronicle* gives a good account of the closing years of the Assyrian Empire and the rise of the Late Babylonian Empire. The *Canon of Ptolemy* is a list of Babylonian and Persian kings, with the length of their reigns, from Nabonassar (747 B.C.) to Alexander the Great. The *Era of Nabonassar* begins in 747 because in February of that year the Babylonians instituted an astronomical calendar, consisting of a 19-year cycle with 7 intercalated months within the cycle, which closely approximates a true astronomical calendar. The Greek astronomer Ptolemy used this calendar as the basis for his canon. Dates of some important Assyrian kings, according to Olmstead, are:

Tiglath Pileser I	1115-1102 B.C.
Ashur-nasir-apal II	885-860
Tiglath Pileser III	746-728
Sennacherib	705-681
Ashur-bani-apal	669-626

Hebrew Chronology.—It is probably true that the chronology of no other people has received a greater amount of scholarly attention than that of the Hebrews. Furthermore it is customary practice to base biblical chronology upon the fairly well-established chronology of the Assyrians. In the accounts of the reigns of the kings of Israel and Judah the duration of each reign is recorded with cross references telling in what year of the reign of a king of Judah a king of Israel came to the throne, and vice versa. In spite of all these facts biblical chronology has remained a perplexing tangle of seemingly insoluble problems.

To begin with, the recorded years of the reigns of the kings of Judah to the fall of Samaria amount to 31 more than the years of the kings of Israel over the same period, and no cross references after the first two reigns are correct. The years from the First Temple to the Second number exactly 480. The years of the kings of Israel number 240. The period from Abraham's departure from Ur to the Exodus was 480 years and from the Exodus to the First Temple was 480 years. It is evident that the Hebrew chroniclers were seeking symmetry and not accuracy.

It is now believed that the reigns of the monarchy period were stretched to make them conform to the 480-year span, that the period of the exile of the Hebrews in Egypt was extended to make it coincide with the Hyksos invasions, and that the Greek translators of the Septuagint, when they learned from Manetho's recently published (c.280 B.C.) *Aegyptiaca* of the early date of the first Egyptian king Menes, lengthened the lives of the patriarchs to make Hebrew history antedate the Egyptians. Using a synchronism to fix 853 as the last year of Ahab's reign, Edwin R. Thiele has worked out a very precise chronology for the kings of Judah and Israel in *The Mysterious Numbers of the Hebrew Kings* (Chicago 1951).

Late Babylonian-Early Persian (Achaemenid) Chronology, in contrast to other early chronologies, can be presented with assurance of a high degree of correctness. Nearly a century has passed since George Rawlinson published his first edition of *Five Great Monarchies of the Ancient Eastern World* (1862-1867). Of these the first four are hopelessly out of date, but his Fifth Monarchy, the Achaemenid Empire, is still a standard work on the subject. The reason is that Rawlinson possessed virtually all the important sources available to us.

Tables for translating dates from the Babylonian-Persian calendar to the Julian Calendar for the period 626 B.C. to 45 A.D. have been prepared by Parker and Dubberstein which, according to the authors, are astronomically correct to the day in 70 per cent of the cases and may be off by one day in the remaining 30 per cent.

Hindu Chronology.—The Hindu civil year is based upon a sidereal solar year which does not take into account the precession of the equinoxes. Hence there is a slight discrepancy between their year and a true astronomical tropical year. Moreover, the Hindus are divided in their allegiance to 3 different figures for a solar year: 365 days, 6 hrs., 12½ min., according to the

astronomer Aryabhata; 365 days, 6 hrs., 12 min., 30.915 sec., according to the *Rajamriga ka*; 365 days, 6 hrs., 12 min., 36.56 sec., according to the *Surya-Siddhanta*. Aryabhata's year exceeds the Julian year by 5 days in 576 years. His civil year begins as the sun enters Mesha (Aries). In A.D. 603 that was on March 20; now, because of precession, it is occurring in April.

Of the many eras observed in different parts of India the most important are six. (1) The *Kaliyuga Era*, an astronomical system which is still referred to but is not now used for civil purposes. It appears to have been adopted in the 4th century A.D., but its epoch is reckoned from Feb. 18, 3102 B.C. The year 1953 A.D. marked the 5,055th year of the era. (2) The *Vikrama Samvat Era* of northern India began on February 23, 57 B.C. 1953 marked the 2,010th year of the Vikrama Era. (3) The *Saka Era* of southern India, with its epoch of March 3, A.D. 78, is in general use in many parts of India. 1953 was the 1,875th year of the Saka Era. (4) The *Saptarshi Era*, used in Kashmir and some of the Hill states, dates from the moment when the Saptarshi were taken into heaven and became stars of the Great Bear in 3076 B.C. (5) The Buddhists reckoned from the reputed date of the death of Buddha in 543 although he actually died in 483 B.C. This era is still used in Ceylon, Burma, and Siam. (6) The epoch of the Jains was the death of Vardhama, the founder of their faith, in 527 B.C.

Chinese Chronology.—Sometime before 2000 B.C. the Chinese adopted a lunar calendar for their civil year and, by intercalating months, adjusted the lunar calendar to an astronomical year, which they recognized as being $365\frac{1}{4}$ days in duration and in which they intercalated a day every 4 years. Since 206 B.C. the civil year began with the first day of that lunation during which the sun entered the Chinese sign for Pisces. At the same time the Chinese adopted a 19-year cycle, with 12 common years of 12 lunations each and 7 intercalary years with 13 lunations. The months were of 29 or 30 days' duration, but it is not known how these were distributed.

The astronomical year was divided into 12 equal parts, each *tsee* being 30 days, $10\frac{1}{2}$ hours in length. Lunar months were designated by *tsee* names, and in years with 13 lunations, the intercalary month kept the name of the preceding month. Thus the Chinese were able to devise a system of reckoning by cycles of 60. Each of the days in the cycle had a particular name and a date could be noted by the name of the day, month, and year. This practice is helpful to students in verifying Chinese chronology. The Chinese reckon the first year of the first cycle as the 81st year of Emperor Yao's life (2277 B.C.)

Since 163 B.C. records have been kept according to Nien-hao. These were periods of regnal years, each emperor decreeing that the years were to be known as the first, second, third, and so on, of his reign or of some other name. To convert a Chinese date into one in a Western era, it is necessary to refer to a table of Nien-hao. W. F. Meyers, *The Chinese Reader's Manual* (Shanghai and London 1924), offers handy conversion tables of Nien-hao.

When the Chinese Republic was established in 1911, our Gregorian Calendar was adopted. Until 1930 the old and new systems were used side by side, but since then publication and use of the old lunar calendar have been prohibited. Even

so, it is still in use to some extent in China, and is used in Tibet. An official calendar corresponding to our Western calendar is published each year by the Academia Sinica at Nanking.

Japanese Chronology.—There are various ways of reckoning eras among the Japanese.

(1) By a continuous era beginning with the first year of the reign of Jimmu-tenno (660 B.C.).

(2) By reigns of emperors, beginning with the first civil year of the new emperor. At the death or abdication of an emperor the current year was usually counted in his reign, and the reign of his successor began the following year. On rare occasions when the official enthronement of an emperor was delayed for some years after his actual accession, his reign was reckoned from the official enthronement.

(3) By periods, called Nengo. In A.D. 645 the Japanese adopted this system from the Chinese of counting by periods of no fixed length, each with a distinctive name. The first period was called Taikwa, and the system has been in use with a few intermissions ever since. In 1872 it was decided that each emperor's reign should henceforth have only one Nengo.

(4) According to sexagenary cycles, also borrowed from the Chinese. These 60-year cycles of five 12-year periods began in A.D. 424.

The Japanese calendar is Gregorian, in all respects like our Western calendar.

Accurate tables of the various Japanese reckonings are easily accessible. E. W. Clement has prepared conversion tables of Japanese, Chinese, and Korean eras in the *Transact. Asiat. Soc. of Japan*, v. 37, pt. 2 (1910), pp. 133-303.

Greek Chronology.—Although each city-state in Greece had its own calendar, with its own names for the months and its own time for beginning the calendar year, the structure of all their calendars was the same. They were lunisolar, with the year divided into 12 months, alternating in length between 29 and 30 days, the lunar year being $11\frac{1}{4}$ days shorter than the solar year. In order to reconcile lunar and solar years the Greeks adopted at some unknown date (in Central Greece perhaps as early as the Mycenaean Age) an 8-year cycle, with 3 intercalated months during each cycle (*oktacteris*). During the 4th century B.C. a more precise scheme, taken from the Babylonians by Meton, was introduced into Athens. This was the 19-year (Metonic) cycle of years of 12 lunar months, with an intercalated month in the 3rd, 5th, 8th, 11th, 13th, 16th, and 19th years. In the cycle 110 months were "hollow" (29 days) and 125 were "full" (30 days). This makes the average duration of a year $365\frac{25}{100}$ days.

During most of the ancient period the Greeks did not observe an era but designated each year by a local magistrate in office at the time: at Athens the first archon, at Sparta the first ephor, at Argos by the priestess of Hera, a lifetime office. The names of ephors are recorded from 757/756 B.C. and of archons from 683/682 B.C. For Athenian archon-lists see the publications of W. B. Dinsmoor. Dating by local officials is confusing and makes chronology almost impossible. The ancient Greek historians recognized this handicap and during the 4th century B.C. a system of dating from the traditional date of the first Olympiad (776 B.C.) began to be adopted. An Olympiad began with the quadrennial celebration of the Olympic Games, held on the first new moon after the summer solstice.

To convert Olympiads into modern dating multiply the number of Olympiads by 4; if this can be subtracted from 780, the remainder gives the year B.C. when the first year of the given Olympiad begins; for the second, third, or fourth years of the Olympiad, 1, 2, or 3 must be added before the subtraction is made. Thus the third year of Olympiad 75 is 477 B.C. (780-303). For a date in the Christian Era 779 should be subtracted from 4 times the number of the Olympiad. Thus Olympiad 293 begins in the middle of A.D. 393 (1172-779). Since the Olympiads began about July 1, we use double years to express entire Olympic years in modern dates. If an event in Greek history is known to have occurred in the first or last half of our calendar year, the customary double year used by historians is unnecessary.

Roman Chronology.—All European countries have borrowed their civil calendars from the Romans. Tradition reports that the second Roman king, Numa, added two months, January and February, to the earliest Roman calendar, bringing the number of months to 12 and the days of the year to 355, and to overcome the discrepancy of $10\frac{1}{4}$ days between the lunar and solar year, he ordered that an intercalary month of 22 or 23 days (alternately) be inserted every second year between the 23rd and 24th of February. A 4-year period thus contained 1,465 days and the mean length of the year was $366\frac{1}{4}$ days. Another correction was introduced at an unknown date according to which every third period of eight years, instead of containing four intercalary months totaling 90 days, should contain only three months, consisting of 22 days each. This Roman luni-solar calendar now had a mean year of $365\frac{1}{4}$ days. Nevertheless the Roman calendar was permitted to stray far from the astronomical year. This was the fault of the priests, who had the power to intercalate months and who abused this power for political reasons. Cicero, suffering the anguish of a political exile while serving as governor of Cilicia in 51 B.C., wrote his friend Atticus to use his influence to prevent an intercalary month, which would extend his tenure, from being inserted at that time.

Caesar put an end to the confusion when, as dictator, in 46 B.C. he decreed that the civil year be regulated entirely by the sun. Assisted by Sosigenes, he fixed the mean length of the year at $365\frac{1}{4}$ days, and arranged that every 4th year should have 366 days. The year 46 B.C., instead of having 355 days, had 445 days to reconcile it with the astronomical year. Caesar arranged that the months should have 30 and 31 days alternately, with 29 (or 30) for February, but his successor, Augustus, to gratify his vanity, named the 8th month after himself, took a day from February and added it to his own month, and revised the number of days in September, October, and November to give us the year calendar which we use today. The first Julian year began Jan. 1, 46 B.C. The astronomical year is not exactly $365\frac{1}{4}$ days and in 1582 Pope Gregory XIII took steps to make the calendar year coincide with the astronomical year. The Gregorian Calendar was not adopted by Great Britain and the English North American colonies until 1752, and the Julian Calendar is still used by adherents of the Greek Orthodox Church.

The Romans in Republican times designated the years by the names of the consuls of the year. This awkward system was an annoyance

to historians who sought to establish a chronological epoch. Different dates for the foundation of Rome were set by Fabius Pictor, Polybius, Cato, Verrius Flaccus, and Varro. A knowledge of these dates is necessary in order to reconcile Roman historians with each other and with modern dating. Livy, for instance, at times uses the epoch of Cato and at other times that of Fabius Pictor. Modern chronologists adopt Varro's date for the founding of Rome (Apr. 21, 753 B.C.). Since the year 753 A.U.C. ("from the founding of the city") is the year 1 B.C. and 754 A.U.C. is A.D. 1, in order to convert a date A.U.C. into modern reckoning, we must, if it is smaller than 753, subtract its number from 754, for a B.C. date, or, if larger than 753, we must subtract from it the number 753, for an A.D. date.

Mohammedan Chronology.—The Moslem era is reckoned from July 16, A.D. 622, the day following the first day of the month preceding the flight (*Hejira*) of Mohammed from Mecca to Medina. Hejira years are used in Arabia, Egypt, Turkey, Persia, and in parts of India and Malaya. The system was adopted close to the time of the Hejira. The Mohammedan calendar is a lunar one: the years consist of 12 months, each containing 29 or 30 days arranged alternately; an intercalated day comes at the end of the 12th month in appointed years in each cycle of 30 years. The purpose of the intercalated day is to reconcile the first day of the month with the day of the new moon. In each cycle of 30 years, 19 are common and contain 354 days and 11 are *kabishah* and contain 355 days.

To ascertain whether a Hejira year is common or *kabishah*, divide it by 30. The quotient gives the number of completed cycles and the remainder indicates the place of the year in the cycle in question. If the remainder is 2, 5, 7, 10, 13, 16, 18, 21, 24, 26, or 29, the year is *kabishah* and consists of 355 days.

The year 1953, Gregorian Calendar, as recorded in Hejira years 1372-1373 follows:

Jomada I (30)	H.Y. 1372	began on Jan. 17, 1953
Jomada II (29)		began on Feb. 16
Rajab (30)		began on Mar. 17
Shaaban (29)		began on Apr. 16
Ramadan (30)		began on May 15
Shawwal (29)		began on June 14
Dulkaada (30)		began on July 13
Dulheggia (29 or 30)		began on Aug. 12
Muharram (30)	H.Y. 1373	began on Sept. 10
Saphar (29)		began on Oct. 10
Rabia I (30)		began on Nov. 8
Rabia II (29)		began on Dec. 8

Reliable conversion tables of Mohammedan dates are easily obtained. See *Bibliography*.

Medieval Chronology.—A man who traveled in the Middle Ages must have been confused by the numerous systems of reckoning time that varied from town to town and country to country.

Under the Roman Empire years were indicated by the names of the consuls; in the West no consuls were appointed after A.D. 534 and in the East after 541. Thereafter years were designated *post consulatum Paulini* in the West and *p. c. Basilii* in the East. In 566 the Byzantine Emperor Justin II assumed the consulship himself and henceforth Imperial years were reckoned from the January 1 following the emperor's accession. Monarchical countries in Europe reckoned by regnal years but the practice differed. The Franks counted regnal years from the king's accession, but Charlemagne dated from his coronation and this practice was usually ob-

served by the French kings. In Germany reckoning for kings was usually from the date of accession, and, if they became emperors, from their coronation, sometimes from both. In England reckoning was from the coronation date until the death of Henry III, since when regnal years have been counted from the accession. The Pontifical Years of the Popes began not with election, but with ordination.

Various Indiction Cycles were employed. The most important were the *Greek* or *Constantinopolitan Indiction*, beginning on Sept. 1; the *Imperial Indiction* or *Indiction of Constantine* (also known as the *Indiction of Bede*), beginning on Sept. 24; and the *Roman* or *Pontifical Indiction*, beginning on Dec. 25, sometimes on Jan. 1.

The most important eras were the *Spanish era*, beginning Jan. 1, 38 B.C., the *era of Diocletian*, beginning Aug. 29, A.D. 284, the *era of the Armenians*, beginning July 9, A.D. 552, and the *Christian era*, which, during the Middle Ages, was a confusing system because the beginning of the year was set at different days in different countries, and some reckoned the beginning of the era during the year before, others during the year after, the birth of Christ. Dionysius Exiguus, the originator of the era, set its commencement on Annunciation Day, Mar. 25, nine months before the traditional date for the birth of Christ. Other days for the beginning of the Christian era were Jan. 1, Mar. 1, Christmas Day, and Easter. Modern scholars have not reached agreement on the actual date of the birth of Christ. Many favor 4 B.C., others 6, 7, 8 B.C., and Olmstead (*Anglican Theolog. Rev.*, 1942, pp. 24-25) would place the date as early as around 20 B.C.

Mayan Chronology.—The ancient Mayas of the Yucatan Peninsula in Central America seem to have been the first people in the world to realize the indispensability of setting a fixed starting point from which to reckon their chronological era. By making observations from their lofty pyramid-temples with a clear sweep of the horizon in all directions, and by carefully marking risings and settings of celestial bodies along the horizon, the Mayas were able to arrive at a figure for the duration of an astronomical year that is actually more accurate than our Gregorian figure:

Astronomical year	365.2422 days
Julian Calendar year	365.2500 days
Gregorian Calendar year	365.2425 days
Mayan Calendar year	365.2420 days

The Mayas were so exact in their time-reckonings that it is possible to date their monuments with respect to each other to the precise day. Difficulties arise when it comes to translating Mayan chronologies into modern chronologies. A number of systems have been developed, each based upon reasonable arguments. The zero date of the Mayan chronological era, "4 Ahau 8 Cumhu," has been set at Feb. 10, 3641 B.C. by Bowditch and Joyce, at Oct. 14, 3373, by Spinden, and at Aug. 13, 3113, by Thompson.

S. G. Morley, in *The Ancient Maya* (Palo Alto and London 1946), divides the history of the Mayas into three major epochs: Pre-Maya (2500 B.C.?–A.D. 317); Old Empire (317–987); New Empire (987–1697). In an appendix in the same book he offers correlation tables of Mayan and Gregorian chronologies. For other chronological systems of the Mayas see the *Bibliography*.

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WILLIAM H. STAHL,
Chairman, Department of Classics, University
College of Arts and Sciences, New York University.

CHRONOMETER, krô-nôm'ê-tēr (Gr. *chronos*, time + *metron*, measure), an instrument for indicating the time of day with high precision. While the term "chronometer" has been applied to several timepieces differing in appearance and construction, accuracy and uniformity of performance are two of the characteristics which distinguish chronometers from other timepieces. This concept is borne out by the fact that the Swiss timepiece industry recognizes at least four styles of chronometers: wrist, pocket, table (*chronomètre de bord*), and marine chronometers. Of these four, only the last named has been generally accepted as a chronometer in the United States. Nevertheless, even the marine chronometer has not been so precisely defined as to exclude the other types, as is shown by the following definition, adopted by a United States government cataloguing agency:

CHRONOMETER—an instrument for precisely measuring time, manufactured to close tolerances to assure the time-keeping qualities of dependability and consistency of rate. These qualities are accurately ascertained by comparison with more exact devices or by astronomical methods so that the accumulated error may be taken into account when determining time. Its usual uses are to indicate Greenwich Mean Time for navigational purposes, and to serve as a reference for less accurate timepieces. It is provided with a winding indicator dial and is mounted in gimbals to maintain the instrument in a level position. It may consist of a spring-driven or other type of movement which is capable of exacting performance without regulation throughout the normal range of room temperatures.

As indicated in this definition, chronometers are usually provided with a wind-indicator hand which shows the condition of wind of the main-spring. Since other timepieces may include this refinement, the presence of this feature cannot be said to be a distinguishing characteristic of a

chronometer, but few timepieces other than chronometers do include an indicator.

In appearance the wrist chronometer resembles a large wrist watch, and the pocket chronometer a pocket watch. The table chronometer often appears similar to a pocket watch, except that it is usually considerably larger, and may be mounted either in a padded case with a window for reading the dial or in gimbals. The marine chronometer is still larger, usually about four inches in diameter; may somewhat resemble an alarm clock; and is almost always mounted in gimbals.

The gimbals consist of a mounting ring with two pairs of pivots at right angles to each other. The chronometer is mounted in the ring and pivots so that it is pendulous, and the dial tends to remain horizontal if the case is tipped, as aboard ship. In this way, performance deviations due to position are eliminated, and chronometers intended for gimbal mounting are rarely tested in any but the dial-up position.

Uses.—Chronometers are employed in determining longitude at sea; as a reference for less precise timepieces, as in watch and clock repair shops; and in scientific work. As electronics has developed, some functions of the chronometer have been supplemented. For example, position at sea is now often determined by loran, but ships still carry chronometers for safety. Both the National Bureau of Standards and the United States Naval Observatory have regular schedules of radio time transmissions, and frequently these signals are used to check chronometers.

Electronic machines have become available to watch and clock makers, but chronometers are still seen in jewelry store windows. Chronometers are still used in scientific work, and often delicate electrical contacts are installed in them to operate an external electrical circuit at precise intervals. This use has made the item name "make-break circuit chronometer" familiar in scientific laboratories.

Accuracy and Performance Requirements.—

The accuracy and uniformity of performance of the four types of chronometers increase in order from the wrist to the marine chronometer. While the standards of testing laboratories vary, the accuracy required of the marine chronometer is uniformly high. Since the United States Navy is probably the largest American user of marine chronometers, the performance requirements of its instruments are a good indication of what can be expected and realized.

The navy does not issue a marine chronometer to one of its vessels if the daily rate of the instrument exceeds 1.55 seconds. (Daily rate is equivalent to the total dial error which the instrument may accumulate in 24 hours by gaining or losing.) Similarly, uniformity of rate is an important requirement, and instruments are rejected if the rate varies more than .50 second from day to day. Both of these figures take temperature into account and are outside limits. It has been established that the large majority of marine chronometers will keep time to 1 second per day or less. This represents an error of 1 part in 86,400, which is roughly equivalent to 12 parts in 1 million, or approximately 0.001 per cent.

Testing and Certification.—The testing of instruments with such small errors requires an even greater accuracy of the standards. Chronometers were formerly tested only at observatories, where they could be compared directly with the

period of rotation of the earth. With the refinements and increased dependability of the quartz piezoelectric oscillator, however, chronometers now are often compared with the oscillators, and the oscillators, in turn, are compared with the rotation of the earth. The National Bureau of Standards maintains a battery of oscillators which are intercompared with each other and frequently compared with time determined by the Naval Observatory. In this way, the resultant errors are so small that received frequency transmissions controlled by the oscillators are accurate within 1 to 3 parts in 10^7 or 10^8 . Since frequency and time are reciprocals, chronometer errors can be determined at any place where the transmissions can be received.

Marine chronometers are usually built to last a lifetime. Thus they are generally tested once after initial assembly and again after each overhaul. The United States Navy's experience indicates that the marine chronometer should receive a complete overhaul, cleaning, relubrication, and test at three-year intervals if high performance standards are to be maintained. This interval is determined largely by deterioration of the lubricants, although worn parts must occasionally be replaced. After the reconditioning operation navy chronometers are subjected to rigorous tests in temperatures of 55°, 72°, and 90°F. The performance characteristics investigated during these tests are amount of daily rate, uniformity of the rate, temperature compensation, recovery from temperature changes, and isochronism.

Chronometers which pass the rate tests are ordinarily certified individually to the final user. The usual certificates consist of a résumé of the test results with dates, and were formerly signed by individuals at the observatories charged with conducting the tests. Out of this custom evolved what was considered a distinguishing characteristic of a chronometer: a performance certificate from an observatory. Like the winding indicator, however, the provision of a certificate can no longer be said to constitute a unique trait, since laboratories may test and certify any timepiece submitted. Individual certificates are seldom justifiable for timepieces other than chronometers.

Construction.—The internal construction of marine chronometers may vary between makes, but there are at least two structural features which rarely appear in other timepieces: the fusee and the detent (detached) escapement.

The fusee is a mechanism designed to transmit constant torque to the train, regardless of the state of wind of the mainspring. In chronometers utilizing the fusee principle, the gear train is driven from a wheel attached to the fusee, rather than from the mainspring barrel, as in ordinary timepieces. The fusee, in turn, is driven from the mainspring barrel by means of a flexible connection, usually a chain, which unwinds from the fusee and winds onto the mainspring barrel as the energy stored in the mainspring is released. The diameter of the mainspring barrel is constant, but the lever arm of the fusee changes continuously as the chain unwinds from it. The changing fusee diameter is designed to compensate for the decrease in mainspring force as the instrument proceeds to run down from the fully wound condition. Thus, in the expression "torque = force \times radius," an effort is made to keep constant the driving torque from the fusee wheel by increasing the acting radius of the fusee as the mainspring force decreases.

The detent escapement is a means for disengaging the balance from the train during as much of its excursion as possible, for in this way its natural period of oscillation can be more nearly approached. Ideally, if the balance and hairspring were without friction, the energy required to sustain its oscillations would be zero, the balance could be entirely detached from any energy-supplying mechanism, and the natural period of oscillation would be realized. Since the energy losses must be supplied, however, the detent escapement is designed to permit sufficient energy to flow into the balance to sustain oscillations but, at the same time, to be engaged with the balance, and thus to interfere with its movement to the minimum extent possible.

In addition to the fusee and detent escapement, the construction of the balance assembly in a chronometer is of interest. All chronometers were formerly equipped with a classical split balance with a bimetallic rim and adjustable compensating weights. During World War II, however, the Hamilton Watch Company built a large quantity of marine chronometers for the United States government, and it was able to eliminate the traditional split balance by using newly developed materials. One of these was Invar, which has an extremely low coefficient of thermal expansion, and this alloy was used for the arm or spoke of the balance. The wheel itself was made of stainless steel, and was not split. This construction provided a more rugged balance, and other advantages also resulted. Most marine chronometers have been made with helical hairsprings, and while the Hamilton instrument retained this feature, improved materials were used in its construction. See also CLOCK.

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BYRON B. MIZELL,

Horological Instruments Branch, Navy Department, Bureau of Ships.

CHRONOSCOPE, krōn'ō-skōp, an instrument for measuring time, especially one for measuring intervals of time, rather than time of day. The intervals measured are usually short, and determined with precision. They may be measured by mechanical, electromechanical, or purely electrical methods. The development of the cathode ray tube has enabled chronoscopes to measure intervals of the order of one millionth of a second.

BYRON B. MIZELL.

CHRUDEM, krōō'dyīm, town, Czechoslovakia, situated in Bohemia, on the Chrudimka River, 35 miles north of Brno. Settled prior to the 11th century, it contains a 13th century Gothic church, a 16th century Capuchin abbey, and a baroque town hall. The town serves as a market for a fertile agricultural district producing mainly sugar beets, and it has sugar refineries, distilleries, breweries, and plants manufacturing cotton textiles, cables, rope, and footwear. Pop. (1947) 13,217.

CHRYSAL, OR THE ADVENTURES OF A GUINEA, a satirical novel by Charles Johnstone, published in four volumes in 1760-1765. Chrysal, the spirit inhabiting a guinea, passes through many hands, from a prince's to a beggar's, and tells its own story, which consists

chiefly of the adventures of those in whose possession it is for the time being.

CHRYSALIS, krīs'ā-līs, the pupa (q.v.) of a butterfly. It is the immobile stage through which the caterpillar is transformed into the adult. When the caterpillar is full grown, it spins a small, silken mat, and when the skin is shed, the cremaster, a spine at the tail end of the chrysalis, is thrust into the mat. If the chrysalis hangs head down, no other silk is spun, but in very many species a silken girdle is spun near the middle to hold the chrysalis in a horizontal or upright position. After the chrysalis is formed, the larval structures almost all break down, forming a thick, liquid mass from which the adult structures develop.

Chrysalides are extremely varied in shape and color. Some are plain, oval, and mummylike. Others have elaborately sculptured shapes or spiny or knobby projections. Some are dull, plain green or brown, while others are brilliantly colored, often with gold or silver markings. Each species holds to its own pattern, and most species can be readily identified by the characters displayed. The chrysalides of the genus *Papilio* are held in an oblique or vertical position by the girdle and have a pair of short horns and a stubby beak at the head end. Pierid chrysalides are generally greenish, and are also fastened by a girdle; they are extremely variable in shape. The chrysalides of most other butterflies hang head down. See also BUTTERFLY.

CHARLES H. CURRAN,

Curator, Department of Insects and Spiders, The American Museum of Natural History.

CHRYSANDER, krü-zän'dēr, Friedrich, German music scholar: b. Lüththeen, Mecklenburg-Schwerin, July 8, 1826; d. Bergedorf, Hamburg, Sept. 3, 1901. He studied philosophy at the University of Rostock, but later devoted himself exclusively to music. From 1868 to 1871, and again from 1875 to 1882, he edited the *Allgemeine musikalische Zeitung*, to which he contributed numerous articles, many of them attacking contemporary trends in music. He also edited *Die Jahrbücher für musikalische Wissenschaft* (2 vols., 1863-1867), and, with others, the *Denkmäler der Tonkunst* (5 vols., 1869-1871) and the *Vierteljahrsschrift für Musikwissenschaft* (1885-1895). The work for which he is best known is his monumental 100-volume edition of the works of George Frederick Handel, published from 1859 to 1894 under the auspices of the German Handel Society, which he helped to found in 1856. Chrysander also began a biography of the composer, but completed only two volumes and the first part of a third (1858-1867).

CHRYSANTHEMUM, a genus of 140 species of annual and perennial herbs and small shrubs with daisylike flowering heads belonging to the family Compositae, and related to *Matricaria* and *Tanacetum*. There are two main centers of distribution: one in the Mediterranean region, where the annual species occur; and the other in China and Japan, where the plants are predominantly perennial. In addition, some of the species have spread throughout Europe and Asia, north into Arctic latitudes, and into North America.

One of the important factors in the evolution of *Chrysanthemum* has been polyploidy, which involves hybridization between the species, fol-

lowed by the establishment in the hybrid derivatives of an increased number of chromosome sets. The original diploid species of *Chrysanthemum*, which possess only two chromosome sets and have a total of 18 chromosomes (9 kinds of chromosomes and 2 of each kind), occur mainly in the Mediterranean region. Throughout the rest of Eurasia there are species with 3, 4, 6, and up to 22 chromosome sets, and with chromosome numbers ranging from 27 through 36 and 54 to 198.

Marguerite is a shrubby species (*C. frutescens*) from the Canary Islands which is grown as an ornamental. Shasta daisy is a very floriferous race selected from wild stocks of *C. maximum* in the Pyrenees Mountains. Corn marigold is a Mediterranean species (*C. segetum*). Pyrethrum (q.v.), an insecticide for the control of household pests, is produced from the dried flowers of *C. cinerariaefolium* and *C. coccineum*, which are cultivated for this purpose (see also INSECTICIDE).

The large autumn-flowering garden chrysanthemums are derived from several wild species in China and Japan, particularly *C. indicum*, *C. morifolium*, *C. ornatum*, and *C. makinoi*. The almost infinite diversity of the garden chrysanthemums is the result of centuries of selection and hybridization, first by Chinese and Japanese gardeners (since about 500 B.C.), then by English and European breeders (since 1789), and later by American horticulturists. These numerous horticultural varieties are commonly grouped according to the arrangement of the individual florets composing the head into several main classes: incurved, incurving, reflexed, anemone flowered, single, and pompon. These groupings are further subdivided into indoor and outdoor varieties; and the latter, in turn, into large, medium, and small flowered. Within each division numerous permutations exist with respect to color of the blooms, ranging from white through pink and yellow to bronze and deep blood red (but not blue or purple).

The common garden chrysanthemums are best propagated from cuttings. Root cuttings are taken in winter or early spring, depending on the variety, and are rooted in a rich and well-aerated sandy loam in a greenhouse. After rooting, outdoor chrysanthemums are gradually hardened by removing to a lath house, and are set out in the ground after the last frosts of spring. Some of the choicest exhibition varieties are grown entirely under glass. Annual chrysanthemums are, of course, grown from seeds.

Chrysanthemums are subject to their full share of fungous diseases and attack by gall midges, root maggots, leaf miners, and various other pests. In each case control consists of fumigation with some appropriate fungicide or insecticide.

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VERNE GRANT,
Rancho Santa Ana Botanic Garden, Claremont,
Calif.

CHRYSANTHEMUM, The Order of the.
See ORDERS AND DECORATIONS—Japan.

CHRYSAROBIN, krīs-ā-rō'bin, a mixture of neutral principles obtained from Goa powder,

a substance deposited in the wood of *Andira araroba*, a Brazilian tree. It is brown or orange yellow in color. Chrysarobin is not administered internally, but applied externally as an ointment, and is said to be of benefit in psoriasis, ringworm, and other parasitic skin diseases.

HAROLD WELLINGTON JONES, M.D.

CHRYSEIS, kri-sē'is, in the *Iliad* (q.v.), the daughter of Chryses, a priest of Apollo. She was captured by the Greeks and given to Agamemnon, who refused to accept her father's offer of ransom. At Chryses' prayer, Apollo sent pestilence and death to the Greek camp. Agamemnon found himself obliged to give up Chryseis, but then robbed Achilles of Briseis, thereby precipitating the dissension between the two heroes which long delayed the conquest of Troy.

CHRYSELEPHANTINE, krīs-ēl-ē-fān'tin, in ancient Greek art, pertaining to statues overlaid with ivory and gold. The frame on which the ivory plates were fastened was usually of wood, and the gold was used for the garments and the hair. The most celebrated chryselephantine statues were the colossal works of Phidias, the largest of which was *Athena Parthenos*, a 41-foot statue of the goddess which stood in the Parthenon in Athens.

CHRYSIPPUS, kri-sīp'ūs, Greek Stoic philosopher: b. Soli, Cilicia, c.280 B.C.; d. 207 B.C. He went about 260 B.C. to Athens, where he attended the lectures of Arcesilaus, but subsequently became a disciple of Cleanthes, whom he succeeded, in 232, as the leader of the Stoics. He defended Stoicism vigorously against the Academy, and did much to systematize it. Of the more than 700 works which he is said to have written, only fragments survive.

CHRYSLER'S FIELD, Battle of (known also as **BATTLE OF CHRYSLER'S FARM**), an engagement in the War of 1812, fought on Nov. 11, 1813. Maj. Gen. James Wilkinson, in command of one of two forces sent to attack Montreal, set out from Sackets Harbor, N. Y., on October 17. The expedition was mismanaged from the start. Both Wilkinson and his second in command, Morgan Lewis, were ill, and John P. Boyd, an incompetent general, was virtually in charge. A flotilla of 300 boats, carrying the infantry and artillery, began the descent of the St. Lawrence River on November 5, while a cavalry brigade of 500 men led by Jacob J. Brown marched along the bank. On November 10, the Americans reached the Long Sault and anchored for the night at Chrysler's Field, on the Canadian side of the river about 90 miles from Montreal. On the following morning, just as the flotilla was about to run the rapids, a British force led by Col. J. W. Morrison approached. In the ensuing battle, Boyd committed his force of 2,000 men piecemeal, and it was easily defeated by the British force of 800 regulars, militia, and Indians. The engagement lasted for about two hours, and the Americans then retreated to the boats, and on the following day ran the rapids to Cornwall. There Wilkinson learned that Wade Hampton, in command of the second attacking force, had ended operations for the season after the Battle of Châteauguay (see CHATEAUGUAY, BATTLE OF), and gone into winter quarters on the Salmon River. American casualties in the Battle of Chrysler's Field

totaled 102 killed and 237 wounded; British, 22 killed, and 48 wounded, and 12 missing.

CHRYSOBALANACEAE, krīs-ō-bāl-ā-nā'sē-ē, a plant family closely allied to the Rosaceae or rose family, and comprising 12 genera with 180 species, all trees or shrubs. *Chrysobalanus icaco*, the coco plum, is found on coasts and along streams from southern Florida to South America, and also in Africa. It is sometimes planted in the extreme southern United States as an ornamental shrub for its sweetish, plum-shaped fruits, which are occasionally used in preserves. The seeds contain a considerable amount of oil, and the astringent bark, leaves, and roots have been used in medicine.

Consult Sargent, C. S., *Manual of the Trees of North America*, 2d ed., pp. 583-85 (Boston 1922).

CHRYSOBERYL, krīs'ō-bēr-īl (Gr. *chrysoberyllos*, golden beryl; known also as CYMOPHANE), a native beryllium aluminate, having the formula BeAl_2O_4 or $\text{BeO} \cdot \text{Al}_2\text{O}_3$, and crystallizing in the orthorhombic system. It is transparent to translucent, with a vitreous luster, and is usually yellow or pale green. The variety alexandrite (q.v.) is green by daylight and columbine red by artificial light. The finer varieties are used as gem stones. Chrysoberyl has a hardness of 8.5 and a specific gravity of 3.5 to 3.84. It is found in Maine, Connecticut, New York, and Colorado in the United States, and in Brazil, Ceylon, Ireland, and the USSR. See also CAT'S-EYE; PRECIOUS STONES.

CHRYSOCOLLA, krīs-ō-kōl'ā, a hydrous copper silicate, having the formula $\text{CuSiO}_3 \cdot 2\text{H}_2\text{O}$. It is cryptocrystalline and usually occurs in opal-like or earthy masses, as incrustations, or with botryoidal surface. When pure, it is translucent and sky blue; when impure, it is often opaque and dull green, brown, or black. Chrysocolla has a hardness of 2 to 4 and a specific gravity of 2.40 to 2.42. It is found in copper mines in all parts of the world, and in the United States occurs in Arizona, New Mexico, Utah, and Nevada.

The word means "gold glue," and the chrysocolla of ancient times was apparently a substance used to facilitate soldering.

CHRYSOLITE, krīs'ō-lit (Gr. *chrysolithos*, gold stone), a native magnesium, iron silicate, having the formula $(\text{Mg}, \text{Fe})_3\text{SiO}_4$. It occurs massive and granular, and also in orthorhombic crystals. Chrysolite is transparent to translucent, with a vitreous luster, and is usually olive green or yellow. It has a hardness of 6.5 to 7 and a specific gravity of 3.26 to 3.441. The finest transparent varieties are used as gem stones. Chrysolite is found in New Mexico and Arizona in the United States, and in Brazil and Egypt. Peridot and olivine (qq.v.) are names often used for varieties of chrysolite. See also PRECIOUS STONES — *Peridot*.

CHRYSOLORAS, krīs-ō-lō'rās, Manuel, Greek scholar: b. about 1355; d. April 15, 1415. He was probably a native of Constantinople. In 1393, Emperor Manuel II Palaeologus sent him to Italy to seek assistance against the Turks. Although his mission was unsuccessful, Chrysoloras himself became known for his learning. Returning to Italy about 1395, he became professor of Greek at Florence, where he remained

for three years. There and at Milan, Pavia, Venice, and Rome, where he later taught, he attracted many scholars, among them Leonardo Bruni, Giovanni Francesco Poggio Bracciolini, and Francesco Filelfo. Popes Gregory XII and John XXIII employed him in public affairs, and he went on missions to France, England, Spain, and Germany. He died while on his way to the Council of Constance as the representative of the Greek Church.

Chrysoloras was the first to reintroduce the study of Greek literature in Italy. He translated Homer and Plato's *Republic* into Latin, and he was the author of *Erotemata sive Quaestiones*, the first Greek grammar used in western Europe; and *Epistolae III de Comparatione Veteris et Novae Romae*, a comparison of Rome and Constantinople.

His nephew and companion in Italy, JOHANNES CHRYSOLORAS, was also a Greek scholar.

CHRYSOMELIDAE, krīs-ō-mēl'ī-dē, a family of Coleoptera containing about 25,000 described species. The antennae are of medium length and slightly clubbed, while the tarsi consist of four segments. The family is extremely varied in size and form, but most of the species are minute to small, with relatively few exceeding one half of an inch in length. The flea beetles are all small and slightly elongate, and have their hind legs adapted for leaping. *Coptocycla* and relatives are flattened, and the sides of the elytra and thorax are thin and extend well beyond the body. The gold beetle (*Metritona bicolor*) is able to change color, but is most generally observed in the gold shade. Species of *Pachybrachys* are short and robust, while the leaf-mining forms are flattened and more or less wedge shaped. For the most part, the free-crawling larvae feed on leaves, while some bore into stems and roots.

The family contains a very large number of pests, including such well-known ones as the Colorado potato beetle (*Leptinotarsa decimlineata*), the twelve-spotted cucumber beetle (*Diabrotica duodecimpunctata*), and the striped cucumber beetle (*Diabrotica vittata*). The elm leaf beetle (*Galerucella xanthomelaena*) feeds on elms and skeletonizes the leaves. The dogbane beetle (*Chrysochus auratus*) is brilliant green and is common on dogbanes.

See also LEAF-BEETLE.

CHARLES H. CURRAN,
Curator, Department of Insects and Spiders, The
American Museum of Natural History.

CHRYSOPHYLLUM, krīs-ō-fil'ūm, a genus of tropical American trees of the sapodilla family (Sapotaceae), consisting of about 60 species. They have a milky sap, and alternate leaves with numerous parallel cross veins and golden hairs on the under surface. In the West Indies the fruit of the star apple (*C. cainito*) is considered a delicacy. The fruits are two to four inches in diameter, with a whitish pulp and three to eight seeds.

CHRYSOPRASE, krīs'ō-prāz, a variety of chalcedony (q.v.), colored apple green by nickel oxide and prized, when brilliant, as a semiprecious stone. It occurs in Oregon and California in the United States, as well as in Silesia.

CHRYSOPSIS, krīs-ōp'sis (commonly known as GOLDEN ASTER), a genus of low peren-

nial herbs of the family Compositae, consisting of about 20 species, native to North America. They have alternate leaves and yellow flowers.

CHRYSORRHOAS. See BARADA.

CHRYSTOSTOM, krís'ús-túm, SAINT John, one of the fathers of the Greek Church: b. Antioch, Syria, ?344; d. near Comana, Cappadocia, Sept. 14, 407. Born of a noble and prosperous Christian family, he was brought up in a spirit of ardent piety by his mother, Anthusa, but, according to the custom of the time, was not baptized until he reached full maturity (c.369). In his youth he studied under Libanius, the famous pagan rhetorician, and was one of his favorite pupils. He wanted to dedicate himself completely to the service of the church, however, and in order to be better prepared for this vocation he retired for several years to a monastery and then to a desert. Returning to Antioch in 381, he was ordained deacon and then, in 386, priest. He soon acquired renown as a powerful preacher and an able missionary.

In 398 he was elected archbishop (patriarch) of Constantinople, capital of the Eastern Roman Empire. Here he continued his strict, ascetic life, neglecting the etiquette of the court and the conventions of his position, and used the large revenues of his see chiefly for charitable purposes. He was deeply concerned with contemporary social problems—poverty, inequality, and injustice—and was very critical of the "acquisitive society" of his time: lust for wealth and power was, in his opinion, the major and ultimate reason for all evil and suffering. It was the cause of social disruption and of moral decay. He was critical even of the artistic splendor of the temples. Nothing was said in the Gospel about golden vessels and fine garments, but there was an emphatic commandment of mercy and love: a cup of cold water offered to the needy is of greater value in God's sight than all decorations and adornments. He was suspicious of wealth as such: was it not ultimately rooted in some injustice? He was suspicious even of private property as such: there was no private property at all in the primitive Christian community at Jerusalem. He would apply the strict principle of complete renunciation, as it was practiced in the cenobitic monasteries, to the church at large. He was not a social reformer, however, but an educator of souls. He had in mind conversion, not an abstract plan to be imposed from outside by formal authority.

Chrysostom was one of the most radical and outspoken prophets of social justice, which was the favorite subject of his sermons at Constantinople. Most of his sermons were exegetical. He interpreted the books of the Bible systematically, covering in his addresses the greater part of the New Testament and some books of the Old Testament. Stenographers took down many of his sermons, which have been preserved as they were delivered. He gained great popularity with the people, but his relations with the court were strained, and the strictness of his administration could not make him popular with the clergy and his fellow bishops. Opposition to him was led by Theophilus, archbishop of Alexandria, who had him deposed by a synod of bishops in 403. The decree could not be put into effect because of the vigorous resistance of the people, and although it was not officially revoked, John was

permitted to resume his office. His enemies finally prevailed, however, and in 404 he was banished to Cucusus, an obscure place in the Taurus Mountains. The people of Constantinople rioted in protest, and the great majority of the bishops of both East and West favored John. He was then to be deported to a wilder region, the desert of Pityus, on the northeast coast of the Black Sea, but he died en route, exhausted by the hardships of travel.

In 417 his name was restored in the diptychs of the Church of Constantinople, and in 438 his remains were solemnly transferred to Constantinople and deposited in the Church of the Holy Apostles. His day in the calendar of the Greek Church is November 13; in that of the Roman Catholic Church, January 27. With St. Basil the Great and St. Gregory of Nazianzus, St. John Chrysostom is described in the Eastern Church as a "great ecumenical teacher and hierarch." The feast of the "three hierarchs" is celebrated in the East on January 30; it is one of the major festivals of the Greek Church.

John's literary legacy is very large and consists mainly of sermons and addresses. His eloquence was exemplary, and soon after his death he was named Chrysostom, from the Greek *chrysostomos*, meaning "goldenmouthed." By education he belonged to the school of Antioch, but he lacked a partisan spirit, and in his exegesis combined the main principles of the rival schools of Antioch and Alexandria. He was not a scholar or a creative thinker, but above all a teacher and pastor. His favorite doctrinal topics were the church, the Eucharist, and the priesthood (his remarkable sermons on this subject were widely read for centuries). He was also much concerned with the ordering of worship, and tradition connects his name with the Communion service commonly used in Byzantium and still used throughout the Orthodox Eastern Church, the liturgy of St. John Chrysostom. (The present rite is, of course, an elaboration of the original rite, but all basic points can be substantiated from references in Chrysostom's sermons.)

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GEORGES FLOROVSKY,

Dean, St. Vladimir's Orthodox Theological Seminary, New York.

CHRYSTOTILE. See ASBESTOS.

CHU HSI or **CHU HI**, jōō' shē', Chinese philosopher: b. 1130; d. 1200. As a student of the Chinese classics, he became widely known through his interpretation of the doctrines of Confucius, and was a founder of the Chinese school of speculative philosophy. He had many disciples, and they, under his direction, rewrote a history of China in 59 books. His influence spread to Japan, where, in the 17th century, a school of neo-Confucianism was named Shushi after him.

CHU-KIANG. See PEARL, river.

CHU SHAN, chōō' shān' (Chin. jō' shān'), or **CHUSAN**, archipelago, China, situated in the East China Sea, at the entrance to Hangchow Bay, off the coast of Chekiang Province. It consists of about 100 islands, of which the largest is Chu Shan, 20 miles long by 10 miles wide. On the south coast of this island is the port of Tinghai. Southeast of Chu Shan is the island of Puto Shan, a Buddhist pilgrimage center with a monastery and many temples. Fishing is the chief occupation of the islanders. Pop. about 400,000.

CHUANG-TZU, jōō-äng'dzü', Chinese philosopher and teacher: fl. 4th century B.C. The leading exponent of the teachings of Lao-tzu, he wrote essays which illustrated his ideas with charming allegorical anecdotes. Of his works, 33 chapters have been preserved.

CHUB, a name given to various species of fishes of the family Cyprinidae (q.v.), of which the river chub (*Hybopsis kentuckiensis*) and the creek chub (*Semotilus atromaculatus*) are the most important in the United States. The river chub is abundant in rivers and creeks throughout the eastern United States, and may be known by its orange-colored fins and the tuberculate head of the males in spring. It reaches a length of 10 to 12 inches, and is a favorite with the less ambitious anglers in certain regions. The creek chub, or horned dace, is even more widely distributed, and inhabits brooks rather than rivers. It resembles the roach, but has a black spot in front of the dorsal fin and does not exceed a foot in length.

The large black chub (*Acrocheilus alutaceus*), of the Pacific Coast rivers, is known locally as chiselmouth, squaremouth and hardmouth. The English chub (*Leuciscus cephalus*) is a much larger fish, attaining a length of two feet and a weight of ten pounds, and lives in mountain brooks as well as in rivers. It is a game fish of considerable importance.

CHUB MACKEREL, a fish (*Pneumatophorus grex*), found in immense numbers in the Mediterranean Sea. It is the "Spanish mackerel" of England.

CHUBB, Lewis Warrington, American research engineer and inventor: b. Fort Yates, Dakota Territory, Oct. 22, 1882; d. Wilkinsburg, Pa., April 2, 1952. After his graduation from Ohio State University in 1905, he began work with the Westinghouse Electric and Manufacturing Company and performed valuable research in the development and application of magnetic materials. In 1920, as manager of Westinghouse's newly created radio engineering department, he helped establish at Pittsburgh, radio station KDKA, the first in the United States. From 1930 until his retirement in 1948, he directed the Westinghouse Research Laboratories at East Pittsburgh. During World War II, he figured importantly in government atomic research and planning and conducted an extensive federal study of jet propulsion. At various times he also contributed to the development of refrigeration, radar, measuring devices, the stabilization and control of gunfire, and weapons for anti-submarine warfare.

CHUBB, Thomas, English controversialist: b. East Harnham, Salisbury, Sept. 29, 1679; d. Salisbury, Feb. 8, 1747. He was a mechanic who employed his leisure in the acquisition of knowledge from the best English books which he could procure. In 1715 he published *The Supremacy of the Father Asserted*, the perspicuity and argumentative skill of which obtained for it much notice. Of course a production assailing the orthodox faith did not pass without reply, and a controversial warfare commenced which lasted as long as his life. Between 1725 and 1732 he offered to the world his thoughts on a variety of topics, moral and theological, in 34 tracts, collected in a quarto volume, of which book Pope in a letter to Gay speaks with great respect. Various publications followed: *Discourse Concerning Reason* (1731); *The True Gospel of Jesus Christ Asserted* (1738); and *An Enquiry into the Ground and Foundation of Religion* (1740).

CHUBB CRATER. Discovered in July 1950 by F. W. Chubb, a Canadian prospector who had detected it on aerial photographs, this circular depression is located in a barren, sub-Arctic area of northwestern Quebec, Canada, in the peninsula between Hudson and Ungava bays, and is believed to be the largest meteorite crater known. With a diameter of about 11,000 feet and a maximum depth of 1,325 feet—more than twice the corresponding dimensions of Meteor Crater, Arizona—Chubb Crater contains a lake, the surface of which lies about 500 feet below the top level of the crater's rim. Scientists visiting the site in 1951 discovered evidence of a large "magnetic anomaly" below the eastern rim, and ripples extending outward for two miles in the granite rock which surrounds the crater, indicating its meteoritic origin. Its age was estimated at a few thousand years.

CHUBB LOCK. See Locks.

CHUBUT, chōō-vōōt', territory, Argentina between the Andes and the Atlantic Ocean, in the northern part of Patagonia, so named from a river which drains a large part of the surface. Its area is 86,751 miles. It is a noted lake region, including Puelo, Menéndez, General Paz and Futalaufquén. Its principal interest lies in its Welsh settlement, which has remained almost wholly Welsh-speaking. The first settlers 151, arrived in July 1865. Epochs in its history have been the abandonment of the colony in 1867; the subsequent return from New Bay; a 20 months' nearly complete isolation from the outer world, terminated in 1871. The principal town, Rawson, is situated about five miles from the Atlantic Ocean, and has a population of 2,500. English grain and roots are produced. Coal, gold, salt, and lead are mined. Alfalfa, grain, potatoes, and fruit are grown. Pop. (1942 est.)

CHUCK-WILL'S-WIDOW, a foot-long, nocturnal bird (*Caprimulgus carolinensis*), closely related to the whip-poor-will, to the common nightjar of Europe and many others, and similarly colored in a mottling of black and buff with some chestnut and white. It is common in the southeastern United States north to southern Missouri, southern Indiana and southern New Jersey, wintering from Florida to Colombia. The

name is an attempt to reproduce the song of the bird. Its enormous mouth, two inches wide, beset with long, branched bristles, fits it for catching its food of flying insects and even an occasional little bird. Its two spotted eggs are laid on the bare ground or fallen leaves of woods or thickets.

CHUCKCHEE SEA, chōók'chê (Russ. CHUKOTSKOE MORE), that part of the Arctic Ocean north of Bering Strait bordered by easternmost Siberia (Chukot National District, q.v.) and northern Alaska.

CHUDLEIGH, Elizabeth, COUNTESS OF BRISTOL, English adventuress: b. Chelsea, 1720; d. Paris, Aug. 26, 1788. She was the only child of Col. Thomas Chudleigh, lieutenant governor of Chelsea Hospital. His death in 1726 leaving his widow in poor circumstances, Elizabeth was brought up in the country. Her first serious love affair occurred when she was about 15 and already a noted beauty. Probably through the interest of William Pulteney, afterward earl of Bath, she and her mother returned to London in 1740; in 1743 Pulteney obtained for the young woman the post of maid of honor to Augusta, princess of Wales. The 19-year-old duke of Hamilton fell in love with her, but while he was making the grand tour of the Continent in the summer of 1744, piqued at his seeming neglect (her aunt intercepting the duke's letters), she married a young naval officer, Augustus John Hervey, second son of Lord Hervey and grandson of the 1st earl of Bristol. Since both were poor and she could not afford to give up her court post, the marriage was kept secret even after the birth of a son in the summer of 1747.

Miss Chudleigh's free behavior in the court of the princess evoked scandalized comments. Horace Walpole describes her at a masked ball in 1749 portraying Iphigenia, "so naked that you would take her for Andromeda." But George II presented her with a watch costing 35 guineas and gave her mother the lucrative post of housekeeper at Windsor. The Chudleighs also owned a 120-acre farm in Devonshire. In 1754 Elizabeth is said to have helped the Prince of Wales (George III) in his intrigue with Hannah Lightfoot.

About 1759 she became the mistress of Evelyn Pierrepont, second duke of Kingston. The liaison was well known when, on June 4, 1760, she gave a magnificent ball to celebrate the birthday of the Prince of Wales. Her parties were now the most fashionable in London. Traveling on the Continent in 1765, at Berlin Frederick the Great paid her some attentions. Desiring to marry the duke without the notoriety of a preliminary divorce, she swore in consistory court that she had never married: the plea was accepted and on May 8, 1769 she married Kingston. Dying four and half years later, he left her his real estate for life and personal estate forever. While she was in Italy, after a brief but characteristically spectacular display of mourning, the duke's nephew Evelyn Meadows had a bill of indictment for bigamy drawn against her. She appeared in the court of King's Bench in May 1775 to answer the indictment, Hervey meanwhile having become earl of Bristol. At the duchess' trial in Westminster Hall before the assembled peers (April 15-22, 1776) her undissolved marriage with Hervey was proved. She escaped from England the day of issuance against her of a *ne exeat regno*.

Retaining her yacht and her large fortune, she lived extravagantly on the Continent, became an intimate of Catherine of Russia, and spent her last years in France.

CHUGACH MOUNTAINS, chōō'gāk, a mountain range in Alaska extending along the southern coast from Cook Inlet eastward for about 280 miles to the western end of the St. Elias Range.

CHUKAR or **CHUKOR**, the Himalayan race (*Alectoris graeca chukar*) of the Rock Partridge, a species (*A. graeca*) which ranges from the Alps of southern Europe to eastern China. It is larger (14½ inches) than any American partridge, a brownish gray bird with a black band across the forehead and completely enclosing the white throat, belly buff, flanks barred with black, gray and chestnut; bill, eye-rim and feet red. It inhabits open country—cultivated land, grass-land and rocky slopes up to snow-line, 16,000 feet in summer. The Chukar is a favorite game-bird and has been naturalized elsewhere, as in Nevada and on the island of St. Helena.

CHUKOT NATIONAL DISTRICT, chōō-kōt', USSR, the easternmost area of the Soviet Union. Its major topographic features are the Chukotski Peninsula (q.v.), the Anadyr Mountain Range, and the Anadyr River with its tributaries. To the west it borders the Yakutsk Autonomous Soviet Socialist Republic, largest division of the USSR, and to the south the Koryak (Koriak) National District. Its area is 254,991 square miles. The capital is Anadyr. Prior to 1930 it formed the northernmost part of Khabarovsk Territory. Sparsely populated, the inhabitants are Chukchi of Paleo-Asiatic origin. The economy is based on reindeer breeding, hunting and fishing. Pop. (1941 est.) 14,983.

CHUKOTSKI, chōō-kōt'skī, or **CHUKOT PENINSULA**, in northeastern Asiatic Russia, situated between Bering Sea to the south and Chuckchee Sea (qq.v.) to the north. Here the Asiatic land mass extends farthest eastward toward the North American continent. At its eastern extremity Cape Dezhnev (East Cape) fronts on Bering Strait. The peninsula forms part of Chukot National District (q.v.).

CHULA VISTA, city, California, in San Diego County; altitude 74 feet; 8 miles south of San Diego; on the San Diego and Arizona Eastern Railroad. It is mostly a residential area, but flowers and vegetables are raised. There is an aircraft plant here. Pop. (1940) 5,138; (1950) 16,505.

CHUMALHARI. See **CHOMO LHARI**.

CHUMBUL. See **CHAMBAL**.

CHUNAR, chū-nār', ancient town and fortress, India, Mirzapur district of Uttar Pradesh, invalid station in Hindustan, 20 miles southwest of Benares, on the Ganges. The fortress stands on a lofty rock rising abruptly from the river. Chunar was stormed by the British in 1763, and formally ceded to the East India Company in 1768. Rice, grain, barley, wheat, and oilseeds are raised. Manufactures include glazed pottery, buttons, and cement. Pop. (1941 est.) 8,654.

CHUNGKING, chōng'k'ing', the wartime capital of China, lies in the central south of Szechwan Province, hundreds of miles beyond the Yangtze gorges, and some 750 air miles from Nanking. It is situated on a series of rugged cliffs at the confluence of the upper Yangtze and Kialing rivers. This ancient but remote city assumed international importance in 1938 when the national government moved its capital from Hankow to Chungking. For several years Chungking suffered constant air attacks by Japan and consequently built an efficient system of air shelters. To promote the development of this area, the national government, during the war, proclaimed Chungking one of the two auxiliary capitals. The city wall of Chungking was built over 500 years ago. Although it was torn down in the 1920's to facilitate modern traffic, remains of the wall and its gates are still in evidence. Chungking was opened to foreign trade in 1891, but it was not until steam navigation was established early in the 20th century that foreign trade in this remote inland port began to develop. Since then modern facilities such as the telegraph, the telephone, and electric light and power have gradually been introduced. The Chinese-Japanese War of 1937-1945 served as an impetus to the modernization of Chungking. Today it is linked with the important cities of China by river, highways, and air lines. Chungking is the key to Szechwan, and the products of this province such as tea, tobacco, and silk are gathered here for transport down the river by junk and steamer, and to cities in the southwest by land vehicles. The population of Chungking increased from about 250,000 in 1937 to over 1,000,000 in 1944 (official est. 1945-1946, 1,002,787). See also CHINA.

CHUQUISACA, choo-kē-sā'ka, Bolivia, department in the southeastern part of the country, bounded on the north by the department of Santa Cruz, on the east by Brazil, on the south by Paraguay and the department of Tarija and on the west by the departments of Oruro and Potosi. Its area is 36,132 square miles. The eastern portion is mostly level, the mountainous parts being in the west. There are large forests and grazing lands, and the soil, where cultivated, is found good for agriculture. Mineral deposits exist, the most valuable being silver, of which some is mined. Among the other productions are wheat, coffee, sugarcane and cacao. The capital of the department is Sucre (q.v.) which was formerly the capital of the republic also. The population is estimated at 400,000.

CHURCH, Albert E., American mathematician and military officer: b. Salisbury, Conn., 1807; d. West Point, N. Y., March 30, 1878. He was educated at West Point and was professor of mathematics there 1834-78. His mathematical works include *Elements of Differential and Integral Calculus* (1842); *Elements of Analytical Geometry* (1851); *Analytical Trigonometry* (1857); *Elements of Descriptive Geometry* (1865).

CHURCH, Alfred John, English translator and author: b. London, Jan. 29, 1829; d. 1912. He was educated at Lincoln College, Oxford; was ordained in the English Church in 1853; professor of Latin in University College, Lon-

don, 1880-88; and rector of Ashley, Gloucestershire, 1892-97. He published translations of Tacitus and Livy. His tales retold from the classics and reconstructions of the histories of the ancient empires of Greece and Rome won him wide popularity on both sides of the Atlantic. *His Memories of Men and Books* was issued in 1908.

CHURCH, Sir Arthur Herbert, English chemist: b. London, June 2, 1834; d. May 31, 1915. He was educated at King's College, London, the Royal College of Chemistry and Lincoln College, Oxford. He was professor of chemistry in the Royal Agricultural College, Cirencester, 1863-79; and filled the same position in the Royal Academy of Arts from 1879 to 1911. He was the discoverer of the animal pigment known as turacin, and of churchite, a native cerium phosphate. He published *Precious Stones* (1883); *English Earthenware* (1884); *The Laboratory Guide* (7th ed., 1894); *Food* (16th thousand, 1901); *Josiah Wedgwood* (1894); *Color* (1887); *Guide to Corinium Museum* (1910); *Chemistry of Paints and Painting* (1901).

CHURCH, Benjamin, American soldier: b. Duxbury, Mass., March 1639; d. Little Compton, R. I., Jan. 17, 1718. He commanded forces with distinction in King Philip's war and in the famous battle of 1675 with the Narragansetts won renown. He captured and executed King Philip in 1676. *Entertaining Passages Relating to King Philip's War* were compiled from his notes by his son Thomas.

CHURCH, Benjamin, American physician: b. Newport, R. I., Aug. 24, 1734; d. 1776. He was graduated from Harvard; and became noted for his patriotic writings in the decade before the Revolutionary War. He secretly corresponded in cipher with the British, and, being detected, failed to exculpate himself. He was lost at sea while on a voyage to the West Indies.

CHURCH, Francis Pharcellus, American editor: b. Rochester, N. Y., Feb. 22, 1839; d. New York City, April 11, 1906. He was the first publisher and editor of the *Army and Navy Journal*; afterward, with his brother, he established and edited the *Galaxy Magazine*. He was a leading editorial writer on the *New York Sun*, and till his death was a proprietor of the *Army and Navy Journal*.

CHURCH, Frederick Edwin, American landscape painter: b. Hartford, Conn., May 4, 1826; d. New York, April 7, 1900. His earliest productions were views of the Catskill Mountains, among which he resided, and a view of East Rock, near New Haven, which attracted very favorable notice. In 1855 he visited South America, and found in the magnificent scenery of that country materials for several of his most admired pictures. After his return he executed his *View of Niagara Falls from the Canadian Shore*, regarded by many as the most successful representation of the great cataract. Among his other works are *The Heart of the Andes*; *Cotopaxi*; *Morning on the Cordilleras*; *Under Niagara*; *The Icebergs*; and *Sunrise on Mount Desert Island*. After a visit to the Holy Land in 1868 he

painted *Damascus* (1869) and *Jerusalem* (1870). His career was cut short in 1877, when his right hand and arm were crippled by rheumatism. Although he learned to paint with his left hand, it too became afflicted, and for the last two decades of his life he was forced to remain inactive. Church was a member of the National Academy of Design, which often exhibited his works.

CHURCH, Frederick Stuart, American illustrator and painter: b. Grand Rapids, Mich., Dec. 1, 1842; d. New York, N. Y., Feb. 18, 1924. He studied painting with Walter Shirlaw and Lemuel Everett Wilmarth in New York, where he exhibited his pictures at the National Academy of Design, to which he was elected a member in 1885. Early in his career he contributed illustrations to *Harper's Weekly*, worked as a commercial illustrator for the Elgin Watch Company, and helped found the Art Students' League of New York (1875). Church is best known as a painter of figures and animals. Among his pictures are *The Sea Princess*; *Moonrise*; *Peacocks in the Snow*; and *Beauty and the Beast*.

CHURCH, George Earl, American civil engineer and explorer: b. New Bedford, Mass., Dec. 7, 1835; d. London, England, Jan. 5, 1910. After several years of practical engineering experience in the United States, he went in 1857 to South America, where he worked as chief engineer of the Great Northern Railway of Buenos Aires and as a member of an Argentine scientific commission exploring the country's southwest border region. Returning to the United States at the outbreak of the Civil War, he served in the Army of the Potomac (1862-1865), and was a war correspondent in Mexico for the *New York Herald* (1866-1867). In 1868 he went once more to South America, where his most important work was connected with the construction of the Madeira & Mamoré Railway between the Bolivian border and northwestern Brazil. In 1880 he was appointed United States commissioner to Ecuador. For the remainder of his life he made his home in London, where he became a fellow of the Royal Geographical Society. His writings include contributions to a number of scientific journals and the posthumous work *Aborigines of South America* (1912).

CHURCH, Irving Porter, American civil engineer: b. Ansonia, Conn., July 22, 1851; d. Ithaca, N. Y., May 8, 1931. He was graduated with a degree in civil engineering from Cornell University in 1873. From 1876 to 1892 he was successively assistant and associate professor of civil engineering at the university, and from 1892 to 1916 professor of applied mechanics and hydraulics.

Church was the author of numerous valuable textbooks on engineering and mechanics, including *Statics and Dynamics for Engineering Students* (1886), *Mechanics of Materials* (1887), and *Hydraulics and Pneumatics* (1889), which were published together in 1890 as *Mechanics of Engineering*, one of the most widely used textbooks in the United States. Among his other works are *Notes and Examples in Mechanics* (1892); *Diagrams of Mean Velocity of Water in Open Channels* (1902); *Hydraulic Motors* (1905); and *Mechanics of Internal Work* (1910).

CHURCH, John Adams, American mining

engineer and metallurgist: b. Rochester, N. Y., April 5, 1843; d. New York, N. Y., Feb. 12, 1917. The younger brother of William Conant Church (q.v.), he was graduated from the Columbia School of Mines in 1867. After metallurgical studies in Europe, he returned to the United States, where he taught at Columbia University (1872-1873) and Ohio State University (1878-1881). As a member of the United States Geological Survey West of the 100th Meridian, he was assigned to make a detailed study of the Comstock Lode, and formed the theory that the presence of heat at the bottom of deep mine shafts was due to chemical action in the rock and not to the earth's fires. Entering the employ of the Chinese government under contract with Li Hung-chang, China's representative with foreign powers, in 1886, Church supervised the reopening of several silver mines in Mongolia, introducing over strong local opposition the use of American methods and machinery. Returning to the United States in 1890, he practiced as a consulting engineer until his death.

His published works include *Notes on a Metallurgical Journey in Europe* (1873); *The Comstock Lode* (1880); and *Report on Artesian Wells in Arizona* (1882).

His son, JOHN ADAMS CHURCH, JR. (b. Prescott, Ariz., Aug. 17, 1885; d. Washington, D.C., Nov. 10, 1952), was also a mining engineer. He was a widely known authority on minerals and collaborated on the *Mining Engineers' Handbook* (3d ed., 2 vols., 1941).

CHURCH, Sir Richard, British military officer and commander in the Greek service: b. Cork, Ireland, 1784; d. Athens, Greece, March 30, 1873. Despite his Quaker upbringing, he enlisted in the British Army at the age of 16. Commissioned soon thereafter, he took part in the Egyptian campaign in 1801. He served subsequently in Malta, Cyprus, and other Mediterranean posts, and in 1809 and 1812 was responsible for creating regiments of Greek light infantry for the defense of the Ionian Islands. His three years of service under King Ferdinand I of the Two Sicilies (1817-1820) were terminated by a revolution in Sicily, where Church had been appointed commander in chief. He was knighted by George IV in 1822.

In 1827, Sir Richard was called to command the Greek insurgent army against the Turks, and after an initial failure to recapture the Athenian Acropolis, was later successful in forcing the surrender of the Turkish garrisons at Missolonghi and Návpaktos (Lepanto). Remaining in Athens after the war, he participated in the revolution of 1843, after which he was appointed a senator under the new constitutional government. In 1854 he became a general in the Greek Army. He continued to live in Athens after his retirement and on his death was given a public funeral.

His nephew, RICHARD WILLIAM CHURCH (b. Lisbon, Portugal, April 25, 1815; d. Dover, England, Dec. 9, 1890), was a clergyman and writer. He was one of the founders of the *Guardian* (1846) and the author of biographies and essays. From 1871 until his death he was dean of St. Paul's Cathedral, London.

CHURCH, Samuel Harden, American industrialist and author: b. Hamilton, Mo., Jan. 24, 1858; d. Pittsburgh, Pa., Oct. 11, 1943. To help support his family, he left school as a youth and

became a messenger boy for the Pennsylvania Railroad Company, in which corporation he eventually rose to be vice president. Meanwhile, he attended and received degrees from several universities and, at its founding in 1896, became a trustee of the Carnegie Institute of Pittsburgh, serving as its president from 1914 until his death. In 1940 he gained worldwide attention by the announcement that he had been authorized to offer a reward of \$1,000,000 for the capture of Adolf Hitler, alive and unhurt, and his delivery to the League of Nations for trial.

Among Church's published works are *Oliver Cromwell: A History* (1894); *John Marmaduke* (1897); *Beowulf*, poem (1901); *Penruddock of the White Lambs* (1907); *A Short History of Pittsburgh* (1908); *The American Verdict on the War* (1915); *Corporate History of the Pennsylvania Railroad Lines West of Pittsburgh* (15 vols., 1898-1920); *Flames of Faith* (1924); and *The Liberal Party in America* (1931).

CHURCH, William Conant, American editor and author: b. Rochester, N. Y., Aug. 11, 1836; d. New York, N. Y., May 23, 1917. The elder brother of John Adams Church (q.v.), he was educated at the Boston Latin School. From 1855 to 1860 he assisted his father, Pharellus Church, a Baptist clergyman, in editing and publishing the *New York Chronicle*. He became publisher of the *New York Sun* in 1860, and, in the following year, Washington correspondent of the *New York Times*, resigning this position on his appointment as captain in the United States Volunteers in 1862. With his brother Francis P. Church, he established the *Army and Navy Journal* in 1863, and in 1866 founded the *Galaxy Magazine*, which he conducted until 1878, when it was merged with the *Atlantic Monthly*. Church was also one of the founders of the Metropolitan Museum of Art in New York, and, with Gen. George W. Wingate, established the National Rifle Association, which he served as its first president.

In addition to numerous articles in various periodicals, he published a two-volume biography of John Ericsson (1890) and *Ulysses S. Grant and the Period of National Preservation and Reconstruction* (1897).

CHURCH, urban district, England, situated in Lancashire, on the Leeds and Liverpool Canal, 20 miles north of Manchester and just west of Accrington. It has plants manufacturing cotton cloth and chemicals for industrial uses. Pop. (1951) 5,199.

CHURCH. The word *church* was probably derived from the Greek adjective *kyriakon* (the Lord's), and referred originally to the building in which Christians met for worship (*kyriakon doma*, the house of the Lord). The English term also conveys the meaning of the Greek word *ekklesia*, which in classical usage meant an assembly, technically a body of citizens summoned by a herald. *Ekklesia* (Latin *ecclesia*) was also used to translate a Hebrew term for the body of those who had been called by God to salvation, and therefore in Christian circles came to mean the community of God constituted by Jesus Christ. In this sense, church refers not only to the visible, institutional aspects of the life of the people of God, but also to the broader totality of the Christian community. This article deals successively

with these three main usages: church as building, church as institution, and church as community of God.

The Church Building.—In the early centuries of persecution, Christians worshipped outdoors, in catacombs, and in private homes. When the Emperor Constantine I (r. 306-337) allowed Christians to worship freely in public, they utilized the Roman basilica as the model for church construction. Basilican churches were long, rectangular, rather low structures with timber roofs supported by long rows of columns. The latter divided the body of the building into a broad, high center aisle (the nave) and two or more side aisles. The eastern end was rounded out into the apse, often domed. Before the apse, on a platform, stood the high altar. This Roman type of church architecture was widespread for several centuries; in Italy its influence persisted into the Middle Ages. (See also *BASILICA*.) In the East, however, Byzantine architecture (q.v.), developed from Roman and Oriental precedents, became popular. This style was characterized by the use of the squared floor plan, domes on pendentives, and rich decorative mosaics. Its influence was especially strong in Eastern Christendom, for in the West the Romanesque development, with heavy walls, round arches, and rounded door and window openings became influential in the early Middle Ages. The floor plan was not rectangular but cruciform; short arms (the transept) were thrust out from the body of the church about two thirds of the way down its length, just before the cancelli, the lattices which separated apse, altar, and choir (the chancel) from the nave. Spires were often added at the point of intersection of transept with nave; one or two towers might also be erected at the entrance end of the church. As this style spread through Europe, it was elaborated in various ways, especially by adding apses to side aisles and transept. (See also *ROMANESQUE ARCHITECTURE*.)

The great period of Gothic architecture came in the 12th to the 15th centuries. The weight of roof vaults was shifted from the walls to lofty, slender stone shafts, counterbalanced by buttresses and flying buttresses. This type of construction permitted the use of pointed arches and thinner walls, and allowed much larger window apertures, thus encouraging the extensive use of stained glass (q.v.). Sculpture was skillfully used throughout the churches and cathedrals of the Gothic period, many of which remain as brilliant monuments to this time of imaginative creativeness. (See also *GOTHIC ARCHITECTURE*.)

The Renaissance promoted a revival of the classical Roman, and in modified form this style influenced the work of Sir Christopher Wren (1632-1723). The plan of his churches was often quite simple: a plain rectangle with shallow chancel. Distinctiveness was added by the originality of tower design. In the 17th and 18th centuries his Georgian style was extensively followed in England (especially after the London fire of 1666) and in America. In the United States in the latter half of the 19th century the Akron theater plan of church building, with corner platform and many small rooms opening onto the main auditorium by great doors, was widely copied. Gothic revivals, which had been influential in the early 19th century in both England and the United States, flowered again in the early decades of the 20th century; their influence

can be seen in a good many of the best-known structures.

See also ARCHITECTURE; CATHEDRALS AND CHURCHES; CHRISTIAN CHURCH ARCHITECTURE.

Church as Institution.—The term "church" is extensively used to refer to the institutions of religion, both to the local congregation and to the larger entity of an organized communion. Whether Jesus Christ was the "founder" of the Christian Church, or whether He was its "inspirer," and its actual organization followed the Resurrection, is a debated point. The primitive church was characterized by intense ardor and confidence, and by a considerable fluidity. Its members were convinced that Jesus Christ was indeed the Messiah, that He had sent His Spirit and would soon return in glory to usher in the kingdom of God in its fullness. There was place in worship for ecstatic manifestations, especially the "speaking in tongues" under the inspiration of the Spirit. Leadership was provided by apostles, prophets, evangelists, and teachers. How a more formal church organization developed is much debated. Some scholars believe that it matured as the church braced itself against threats of persecution from without and dangers of heresy from within. Others believe that the apostles officially established a hierarchical structure by formally appointing their successors (apostolic succession). It is clear, however, that the replacement of the more informal early arrangements by the threefold ministry of deacon, presbyter, and bishop was almost universally completed in the 2d century. The institutionalization of the church was continued further through the spread of the monarchical episcopate, by which a single bishop in an area occupied a position of authority. The development of the idea of the church as a carefully integrated, universal institution was advanced especially by St. Cyprian (c.200-258). He insisted that there is no salvation outside of the visible church, and that the church was founded on the bishops, so that its every act is to be directed by these same presiding officers. The claim that the bishop of Rome had peculiar authority because he was the successor to Peter, the chief of the apostles, was winning wide recognition by the time of Pope Leo I (r. 440-461); this contributed significantly to the institutional formalization of the Roman Catholic Church. In the high Middle Ages the church was understood to be fundamentally the objective, hierarchical institution of salvation, mediating grace through the sacraments and governing as the representative of God on earth.

Against this formalization, however, came protest movements. For example, in the 2d century the Montanists objected both to what they felt was the increasing externality and the moral laxness of the church. They declared that their "church of the Spirit," marked by prophetic fervor and moral purity, was the true one. Throughout church history there has been an increasing number of institutions, some small and some large, which claim to be true churches. Out of the theological controversies of the 5th century came the separation of the Nestorian and the Coptic churches. In 1054 occurred the definitive separation of Eastern and Western Christendom. The Eastern Orthodox churches include the four ancient Eastern patriarchates (Constantinople, Alexandria, Antioch, Jerusalem) and a number of independent, autocephalous national churches, bound by loyalty to a common faith,

defined chiefly by the first seven ecumenical councils. (See also ORTHODOX EASTERN CHURCH.) In addition to these major divisions, many small sects have arisen at various times to trouble the peace of the church.

The Protestant Reformation in its dominant forms (Lutheran, Calvinist, Anglican) did not so much break with the institutional concept of the church as it challenged the priestly conceptions of its functions. The reformers emphasized that the will of God was revealed not by human institutions but was made known to men through faith in the reading of the Scriptures. Lutherans believed that the true church was where the word of God was truly preached and the sacraments rightly administered; the precise forms of organization were of somewhat secondary importance. Hence Lutheran churches were organized along national lines (the territorial system) as they spread in Germany and Scandinavia in the 16th century. Calvinists added an emphasis on discipline to the marks of the true church, and exhibited a desire to mold society after the will of God. In England both Catholic and Protestant elements were combined as the national established church was redefined under royal supervision. In these Reformation churches the hierarchical structures were simplified or abandoned. The churches of England and Sweden retained the threefold ministry; other Lutheran and the Calvinist churches have generally had no order which is higher than the pastor or presbyter.

Besides the classical Reformation churches there was a vast range of smaller movements, the "left wing of the Reformation." In these little fluid movements sectarian, rationalist, and mystical elements had opportunity to grow. Especially important were the Anabaptists (q.v.). For them the church was an association of adult regenerate baptized believers. They insisted on the independence of the local congregation and magnified the importance of the Scriptures. The sectarian understanding of the church, with its subordination of the institutional aspect, in modified form became widely influential in Protestant life, especially through the evangelical revival of the 18th century. Modern Protestant views of the church have also been influenced by the rationalistic currents of the Enlightenment, in which the idea of the church as a voluntary society was stressed. Some of the great denominations of the English-speaking world hold a view of the church in which classical and sectarian elements are combined. In bodies with congregational polity (for example, Congregational, Baptist, Disciples of Christ) the local congregation is considered to be the valid institutional form of the visible church, though elaborate denominational structures for the achievement of specific educational and missionary goals are maintained. (See also PROTESTANTISM.)

The Reformation was Catholic as well as Protestant; the Counter Reformation encouraged internal reform and vigorously reaffirmed the traditional Roman Catholic understanding of the church, especially at the Council of Trent (1545-1563). A widely accepted Roman Catholic definition of the church, framed by Robert Cardinal Bellarmine (1542-1621), is: "A body of men united together by the profession of the same Christian Faith, and by participation in the same sacraments, under the governance of lawful pastors, more especially of the Roman Pontiff, the sole vicar of Christ on earth." The capstone of

the hierarchical structure was set in place in 1870 by the authoritative declaration of papal infallibility and primacy. See also CATHOLIC CHURCH, ROMAN—*Doctrine*.

Church as Community of the Faithful.—

The idea of the church as the whole community of God's people was extant before the precise, institutional concepts of the church crystallized. Early Christians thought of the church in this way as the chosen people of God, the faithful remnant, the new Israel, the inheritor of the promises made by God to Abraham. Membership in this new and universal fellowship was not by inheritance but was the result of regeneration, the gift of God's grace. The law of the people of God was the new law revealed by Jesus Christ. The members of this corporate body of God's people who by faith had recognized the Messiah felt themselves to be united by a bond of supernatural love, and to be living in a new relationship of dependence and forgiveness. The church was thus "the body of Christ," for He was the Head Who ruled and directed those who were members of the one body and who were dependent on Him and on one another. The church in this sense of the total community of the faithful was not externally visible; it was glimpsed only by the eye of faith. A closely related idea was that of the communion of the saints, which meant that the fellowship of the church transcended the bounds of space and time, that the full unity of the church extended to all places and embraced all ages.

This understanding of the church as a special community, a new and universal people, has always been an important theme in Christian thought. At times it has strengthened the institutional aspects of the life of the church, but at other times it has contradicted them. In the early centuries it was not carefully distinguished from institutional views, but as various schismatic movements appealed to it as justification for their institutional departures, ways of relating the two views had to be found. This was done classically by the great theologian St. Augustine (354–430). He enunciated the doctrine that although the visible church in history could be distinguished from the true body of the faithful who are saved by God's grace, yet there is but one church. Its temporal manifestation, however, must not be confused with its eternal nature. The church in history is not perfect, it is mixed with the ungodly, but at the last in its eternal fulfillment it will be pure. This view rendered schismatic movements more readily controllable and paved the way for the full medieval institutional development of the Roman Catholic Church.

Movements of renewal and reform, however, were still inspired by the understanding of the church as the whole body of the faithful. Certain monastic orders and medieval sects were influenced by it; at times they sought to realize within their own groups something of the reality and vividness of primitive Christian community consciousness. This view also contributed to the thought of such advocates of reform as John Wycliffe (1320?–1384) and the conciliarists who sought to reform the church through general councils.

The Protestant Reformation of the 16th century placed particular stress on the idea of the church as community of the faithful. Martin Luther (1483–1546) emphasized the church as a company of God rather than as an institution

mediating grace. For him, the church was a community which extended over God's world and embraced all ages; it was God's creation, known only by faith. The essential, true church was "inner" Christendom; the external, visible manifestations were but "outer" Christendom. John Calvin (1509–1564) carefully distinguished between the invisible and the visible church. The former was the whole body of the elect, known only to God. The visible church was the training ground for the elect and the instrument for bringing the will of God as revealed in the Bible to bear on the common life; hence its organization could be suited to particular situations.

The smaller Protestant sects also sought to return to the primitive conceptions of church as community, often striving to realize within their memberships the ideal Christian fellowship. This led on the one hand to an emphasis on separation from the world, and on the other to an effort to remold the world after the envisioned ideal. In modified form, sectarian and Calvinist views have been very influential in Anglo-American Protestantism.

See also CHRISTIANITY.

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ROBERT T. HANDY,

Associate Professor of Church History, Union Theological Seminary.

CHURCH-ALE, formerly a church festival in England at which ale was drunk liberally. The word is similar in its derivation to bride-ale (bridal), scotale, clerk-ale, bid ale, and the like. Church-ales were held in the churchyard, or sometimes in the church, usually at Whitsuntide. Two persons were chosen beforehand to preside over the feast and divide the food and drink contributed by the parishioners. Sometimes the drink which had been brewed from malt given by the parishioners was sold about Whitsunday at the church for the support of orphans and the poor, the repair of the church, and similar purposes.

The practice of holding church-ales with corresponding games was denounced by the Puritans, particularly by Philip Stubbs in *The Anatomie of Abuses* (1583).

CHURCH AND STATE. Before the Christian era religion was usually so closely identified with state or national interests that clear-cut conflicts between the institutions of religion and government rarely developed. In the Roman Empire, for example, the emperor was pontifex maximus, the high priest of the traditional religion; other faiths were in general treated with broad toleration. Between Christianity and the empire, however, tension soon arose. Christians were committed to a loyalty higher than that of the state, they refused to honor the Roman deities, and they made claims as to the universal validity of their faith. Jesus' command to "Render to Caesar the things that are Caesar's, and to God the things that are God's" (Mark 12:17) provided the basis for Christian allegiance to the state, but where the dividing line between the two loyalties was to be placed in given situations was difficult to decide. Varying attitudes toward the state are reflected in the New Testa-

ment. St. Paul's declaration that "the powers that be are ordained of God" (Romans 13:1) is far different from the negative tone with respect to the state that characterizes the Book of Revelation. Throughout Christian history the way in which church and state should be related has been a thorny problem. Church may be entirely separate from state, it may be subject to it, it may be dominant over it, or some form of coordinate authority may be worked out—these various possible solutions have been worked out in theory and tried in practice throughout the succeeding centuries.

During the first several centuries the church was of course independent of the state; the separation was a most unfriendly one, as Christianity was spasmodically persecuted by the empire as an illegal religion. But the faith steadily spread despite attack. In 313, through the influence of the Emperor Constantine I, toleration was officially granted to the church by the Edict of Milan. With the favor and aid of Constantine, the church grew in size and power until by the end of the 4th century it had become the only legal religion in the empire; the intimate connection between church and state that was to endure for centuries was established. In the East, particularly after Constantinople became the sole capital of the empire, the church was subject to the close supervision of the state. This arrangement, known historically as caesaropapism, has often characterized the conditions under which the different Eastern Orthodox churches have lived.

In the West, however, the church often enjoyed a more independent status, particularly after there was no longer an emperor at Rome. To be sure, for some centuries secular authorities exercised considerable control over the church in various ways, but in the medieval period the church rose to a position of dominance over the state. In the medieval Catholic theory of the two swords, the sword of temporal authority was to be wielded by the state, but in the interest of the church and at its direction, for the sword of spiritual authority was held to be superior to all earthly powers. The church rose to its apex of authority during the papacy of Innocent III (1198–1216). He intervened decisively in the most important political issues of his time. He used his influence to have kings disciplined and emperors deposed, and he granted England and some other lands as papal fiefs. He compared the relation of ecclesiastical to civil authority with that of the sun to the moon, the latter shining with the reflected glory of the former.

In the 14th and 15th centuries, however, the rise of national states brought about a new situation in which the power of the church declined. In country after country church interests were subordinated to national interests; the residence of the popes at Avignon (1309–1377) and the Western Schism (1378–1417) both illustrate this trend.

The Protestant Reformation did not at first challenge the close tie between church and state. The principle of religious uniformity enforced by secular authority was believed necessary to civil peace and was affirmed by the major Reformation traditions, Lutheran, Calvinist, and Anglican. Martin Luther (1483–1546) looked to the princes for help in reforming the churches of Germany. Reform in Zurich and Geneva was carried out with the aid of the city councils. In England the

Reformation proceeded under royal direction. But among the great number of small, left-wing sects that arose during the Reformation were many in which any connection between church and state was repudiated on principle. The Anabaptists (q.v.) especially believed that the use of force was foreign to the nature of Christianity, and that the state had no proper jurisdiction in religion. They drew a clear distinction between civil and spiritual offenses. Differences of opinion in matters of religion they thought to be inevitable and legitimate. They agreed that a given religious body should keep its own faith pure by internal discipline, but they were opposed to any outside interference or supervision on principle. Such groups were persecuted by both Catholic and Protestant states in the 16th century, but gradually many Protestants representing the classical as well as the sectarian traditions came to feel that religious liberty was the logical outcome of Reformation principles, and that it could best be safeguarded by the separation of church and state. Especially out of English and American Puritanism, in which Calvinist and sectarian motifs were intertwined, outstanding champions of separation emerged—such individuals as Roger Williams (1603?–1683) and William Penn (1644–1718), and such groups as the Baptists and the Quakers.

In the United States, for the first time in many centuries, a nation of the West without any form of national religious establishment arose. When Protestantism was first brought to North America, less than a century after Luther, the patterns of religious uniformity were generally accepted. In 9 of the 13 English colonies churches were established. But a number of factors—geographic, economic, political, social, and theological—worked together to produce toleration and finally religious liberty. When the Constitution was prepared, separation appeared to be the best way of dealing with the church-state problem and the surest way of safeguarding religious freedom. Article VI provides: "... no religious test shall ever be required as a qualification to any office or public trust under the United States"; and the 1st Amendment declares: "Congress shall make no law respecting the establishment of religion, or prohibiting the free exercise thereof. . . ." (See also *UNITED STATES—Religion and Form and Constitution of the Federal Government*.) This pattern of the friendly separation has spread widely, though in some European countries Protestant state churches remain, in most cases with full religious liberty for dissenters.

In countries such as the United States, where separation has become a fact, Roman Catholics have generally accepted it on pragmatic grounds. Theoretically, and practically where possible, Catholicism officially believes in the union of church and state, affirming that Roman Catholicism should enjoy the favor of the laws and the patronage of public authority. Roman Catholicism has felt that matters of marriage legislation and education especially are within its particular sphere of authority, inasmuch as they deal with matters of faith and morals. These positions have led to some bitter conflicts as modern nationalism has disputed Catholic claims. In France there was a period of unfriendly separation (1795–1801) during the revolutionary epoch. In the effort to regain as favorable a position as possible, the device of the concordat, which has frequently been

used to define the relationship between Roman Catholicism and various states, was used. A concordat with Napoleon in 1801 re-established Catholicism but left it subject to certain limitations. In 1905, France repudiated this concordat, and a period of unfriendly separation that did not ease until after World War I followed. (See also FRANCE—*Church and State*.) In Italy the drive of the nationalists to unify the country succeeded in 1870, and the church was deprived of the remainder of the Papal States. The pope considered himself "the prisoner of the Vatican," and the struggle continued until the Lateran Treaty of 1929 with Italy defined the limits of papal property (Vatican City) and diplomatic relations were restored. (See also ITALY—*History*.) In Germany religious strife broke out in the 1870's as Chancellor Otto von Bismarck attempted to control church activities. Known as the Kulturkampf (q.v.), the struggle ended with the victory of the church. In Latin America about half of the nations have separated church from state; in Mexico particularly there has been sharp conflict between them (see MEXICO—*Church and State*).

A new phase of church-state relationships developed in the 20th century with the rise of Fascist and Communist dictatorships. Christian churches of all traditions resisted absolutist claims made by totalitarian states, and in tense situations have repeated with the apostles: "We ought to obey God rather than men" (Acts 5:29). Among characteristic statements made in the face of Nazi tyranny were the papal encyclical *Mit brennender Sorge* (1937) and the evangelical Barmen Declaration of the Confessional Church in 1934.

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ROBERT T. HANDY,
Associate Professor of Church History, Union Theological Seminary.

CHURCH ARMY, an organization affiliated with the Church of England, founded in 1882 by the Rev. Wilson Carlile (1847–1942), later prebendary of St. Paul's Cathedral, London. Like the Salvation Army, which it resembles, it was established to do mission work in the slums of London and other English cities. It maintains a training school for its workers, lodging houses, clothing and food depots, and employment offices, as well as a fleet of vans which travel throughout Great Britain. In addition, its workers visit prisons.

Branches of the army exist in other parts of the Commonwealth of Nations and in the United States.

CHURCH ASSEMBLY, governing body of the Church of England established by Parliament under the Church Enabling Act of 1919. It consists of a House of Bishops, a House of Clergy, and a House of Laity. See also GREAT BRITAIN—*Church of England*.

CHURCH CALENDAR, the arrangement of the feasts of the Christian Church during the year. Many of the feasts occur on a fixed day

of the month, such as Christmas, December 25; Epiphany, January 6; Assumption, August 15; All Saints', November 1; and the feasts of the saints (see SAINTS' DAYS). Others, which depend on the date of Easter (q.v.), are movable feasts. Thus, Ascension Day is the fortieth day after Easter; Whitsunday, or Pentecost, the seventh Sunday after Easter; and Trinity Sunday, the Sunday following Whitsunday. Since the date of Easter may fall at any time between March 22 and April 25, there is a wide variation from year to year in the dates of these feasts. See also CALENDAR.

CHURCH COMMISSIONERS. See EC-CLESIASTICAL COMMISSIONERS.

CHURCH DISCIPLINE. See DISCIPLINE, ECCLESIASTICAL.

CHURCH FATHERS. See FATHERS OF THE CHURCH; FATHERS, APOSTOLIC.

CHURCH GOVERNMENT. The system by which the affairs of the local church or congregation and of the denomination are directed. The main principles of church government are derived by various bodies of Christians from the New Testament. Roman Catholics and Episcopalians, Presbyterians and Reformed, Baptists and Congregationalists, whose politics are as different as possible, all believe that their respective systems of church government are derived from the Scriptures, particularly from the Gospels, the Acts of the Apostles, and the Epistles. Apostolic succession is of fundamental importance to the Roman Catholic, the Greek Catholic, and the Anglican communion, and the teaching and practice of the Apostolic Church are, therefore, regarded by them as of binding force. Each traces its succession of bishops, and hence of ordained ministers, back through the ages to one or another of the apostles, and holds that since the time of Sts. Peter and Paul it has had an unbroken succession of the episcopal order. Churches using the presbyterian or congregational order hold that their respective systems are in harmony with the Scriptures and insist that they have a valid ministry. They do not accept the idea of apostolic succession, and do not believe that any particular system is of divine authority, but that churches of Christ are free to adapt their politics to circumstances and conditions, provided that the procedure be orderly. See APOSTOLIC SUCCESSION; also religious denominations mentioned herein.

There are three more or less distinct systems of polity, or church government, generally recognized, known as the congregational, the presbyterian, and the episcopal. There are, however, many modifications or variations of these systems. It is not always possible to determine which particular system a particular denomination employs. The Lutherans in the United States generally classify themselves as congregational; some of them, however, contend that their system is presbyterian, while a few insist that it is really more nearly episcopal. In the Scandinavian countries the Lutheran is the state church and has bishops.

1. The congregational method regards the local church, or congregation, as having full control of its own affairs, and as not subject to legislative or executive direction by any denominational organization or even by the

whole denomination itself. That is, each local church is a complete body in itself with inherent authority to conduct all the business appertaining to itself. The principles of fellowship and cooperation, however, come in to modify any tendency toward strict independency of the local church, which feels that it ought to be related to other churches of like faith and order, and recognizes that fellowship is concerned to know, when a new church is organized and seeks the recognition of other neighboring churches of the same name and order, what are its doctrines, principles, and practices, and when it calls a pastor, to be assured of his standing and qualifications. Hence, associations or conferences of contiguous churches, and councils for recognition, ordination and installation, and hence, also, cooperation in the support of denominational missionary, educational, and other boards or societies. Congregationalists and Unitarians and the various Baptist bodies, with other denominations, accept the congregational system. Baptists and Congregationalists in the last half century have developed denominational conventions and councils for the supervision of general denominational activities.

2. The presbyterial system is government by presbyters, which is another word for elders. Presbyters (John Milton said, "New presbyter is but old priest writ large") are elder ministers, or teaching elders, bishops or pastors, and there are also in each local church ruling elders, who are laymen, and with the pastor constitute the session or consistory. Control in each church is exercised through the session or consistory; then comes the presbytery or classis, composed of pastors and elders of the churches of a district; then the synod, consisting of representatives from presbyteries or classes, and then the general synod or the general assembly, the chief legislative and judicial authority of the denomination. All Presbyterian and Reformed churches use the presbyterial form of government, and, strictly speaking, that of the Methodists is more akin to the presbyterial than to the episcopal polity, although they have bishops. The Methodist bishop is a general overseer or superintendent, but has no legislative power and is subject, under a few constitutional restrictions, to the legislative, executive, and judicial authority of the general conference, the supreme governing body.

3. The episcopal system centers in the bishop. The Roman Catholic Church is governed by the pope as bishop of Rome, which it calls the primal Christian see. He creates cardinals, archbishops, and bishops, calls ecumenical councils at long intervals to advise him, but he is always the supreme head of the church, "the vice regent of Christ on earth." The Anglican Communion and the Eastern Orthodox churches are also episcopally governed, though the state comes in to modify the system somewhat. The Protestant Episcopal Church of the United States has a triennial general convention, composed of two houses, the house of bishops and the house of clerical and lay deputies, the latter elected by the diocesan conventions. This is the supreme legislative body of the church. Concurrence of both houses is necessary to the enactment of legislation. The Methodist Episcopal Church, a type of a number of bodies similarly organized, weds supreme legislative and judicial power in the general conference, a body composed of ministerial and lay delegates elected by the annual

conferences and lay electoral conferences. The bishops preside over its sessions but are not members of it and have no part in its proceedings except as presiding officers. Prior to 1872 this body consisted solely of ministers; since that date laymen have participated in the government of the church. The patronage of the church, the appointment of pastors, is vested by the constitution in the bishops.

The denominations provide judicial courts to determine the validity of ecclesiastical legislation and to try ministers and laymen accused of offenses against doctrine, discipline, and morality, according to the polity in use, recognizing the principle generally that ministers should not be condemned except by tribunals constituted of ministers or of ministers and laymen.

Briefly, the following distinctions are characteristic of the different ecclesiastical polities: In the congregational form, no convention or council has power to legislate for the local churches or to make and enforce rules for their government. The local church is the fountain of ecclesiastical power. In the presbyterial form, the presbytery is the ecclesiastical unit, but with no power of legislation, which instead rests with the denomination in a representative general synod, or general assembly, consisting of representatives of the presbyteries. In the episcopal system, as represented by the Protestant Episcopal Church, supreme power belongs to the denomination, as in the presbyterial form, but bishops have a coordinate power in legislation with clerical and lay deputies of the dioceses, while in the Roman Catholic Church, the bishop holds, in the person of the pope, all power in his hands.

HENRY K. CARROLL,

Author of "Religious Forces in the United States."

CHURCH HISTORY, the history of any church, but especially of the Christian church. Church history naturally divides itself into four periods: from the advent of Christ to the time of Constantine; from Constantine to Mohammed, or by the arrangement of Johann L. von Mosheim and others, to Charlemagne; from Mohammed, or alternately from Charlemagne, to the Reformation; from the Reformation to the present time. This division of the subject is not always followed; some authors regard the great periods in Church history as: Foundation; Persecution; Extension; Reformation. See also **CHRISTIAN CHURCH, THE**.

CHURCH OF ENGLAND. See **GREAT BRITAIN—Church of England**.

CHURCH OF THE NAZARENE. As the result of the union of several small religious bodies the Church of the Nazarene was organized in its present form on Oct. 13, 1908, at Pilot Point, Texas. The three main groups composing this union were the Church of the Nazarene, founded in Los Angeles, Calif., by Dr. P. F. Bresee in 1895; the Association of Pentecostal Churches of America, organized in Brooklyn, N. Y., in 1896; and the Holiness Church of Christ, organized at Pilot Point, Texas, in 1905. The combined membership in 1908 was over 10,000.

The government of the church is representative, a compromise between episcopacy and con-

gregationalism. Each local church enjoys the right to call its own pastor and to manage its local affairs, subject, however, to the guidance of superintendents who are elected by the district assemblies to which local churches send delegates. There were, in 1951, 63 such districts in the United States, Canada, the British Isles, and Australia, each of which meets annually for transaction of business. The general assembly, which meets quadrennially, is composed of equal numbers of ministerial and lay delegates from the various assembly districts and is the supreme legislative body of the church. Five general superintendents, elected by this assembly, have supervision of the entire denomination. The general board, composed of 24 members, ministerial and lay, elected by the general assembly from the various geographical zones and the church departments, promotes the financial and material affairs of all the departments of the Church of the Nazarene, subject to such instructions as may be given by the general assembly. The Articles of Faith, 15 in number, are similar to those held in common by evangelical religious bodies. Special emphasis is placed upon the doctrine of entire sanctification.

Seven colleges are maintained, and the publishing house, the theological seminary, and the denominational headquarters are located at Kansas City, Mo. Missionary work is conducted in over 20 fields throughout the world, engaging the full-time services of about 1,300 missionaries and national workers. At the close of 1951 there were 242,491 members (exclusive of 33,488 on foreign mission fields), 3,790 organized churches, 499,698 enrolled in the Sunday schools, 78,450 affiliated with the Nazarene Young People's Society, and 90,095 members of the missionary organizations. Gifts for all purposes totaled \$27,099,068, a per capita of \$111.76.

REV. VERNON L. WILCOX,

Pastor of the Church of the Nazarene, Medford, Oregon.

CHURCH OF THE NEW JERUSALEM, a body of Christians founded on the writings of Emanuel Swedenborg (Emanuel Swedberg, q.v.). In this church Jesus is directly worshipped as God, in whom is the Father, the Son, and the Holy Ghost. Christ is creator and redeemer, the word and the revelation. The Father is the divine inmost, the divine love; the Holy Ghost is the divine proceeding in and for man. Thus the New Church, as the Church of New Jerusalem is often called, reverses the usual trinitarian view of approach to God through Christ. As to Christ's second coming, Swedenborg held that it occurred when the interior meaning of the Scriptures was revealed to himself in 1757, and that universal judgment accompanied this advent in which the religious beliefs of mankind were overturned and recast. In other words, the New Church means a new dispensation following the apostolic as the apostolic followed the Jewish, and embraces all who acknowledge these three essentials: (1) the divinity of our Lord; (2) the holiness of the Word; (3) the life of love; and who unite with the New Church. The ritual is similar to that of the Anglican Church, except that it is all addressed to Christ as God, and not through Christ to another of the Trinity. Two sacraments are observed—baptism, through which angelic association is formed, and the Lord's Supper, in which

the Lord is not present materially but really in the divine good and truth, which are his body and blood.

Societies of the New Church exist in England and many other foreign countries. There are two divisions of the body in the United States, one known as the General Convention, the other as the General Church.

HENRY K. CARROLL,

Author of "Religious Forces in the United States."

CHURCH RATE, in England, a rate raised for the purpose of repairing and sustaining the established parish churches, churchyards, and other ecclesiastical objects. It was made by the churchwardens with consent of the parishioners, who fixed the amount, but could not refuse it altogether, as in that event the churchwardens were empowered to levy a rate for necessary purposes. Church rates originated in the four charges laid on the tithes (q.v.), one for church edifices, the others for the support of the bishop and clergy and for charity. Used only for parish churches, the rate was assessed against all denominations alike. The Nonconformists objected to contributing to the support of the Established Church, and a similar grievance was held by the predominant Roman Catholic population of Ireland. These difficulties were ended in 1868 by the passing of the Compulsory Church Rate Abolition Act, which provided that church rates are voluntary, not obligatory.

CHURCH STATES, the former dominions of the popes or Roman pontiffs in Italy. Prior to 1870, the Papal States covered a territory stretching across mid-Italy from sea to sea and comprised an area of 16,000 square miles, with a population of 3,124,758. The states originated with the grant of Pepin, king of the Franks, in 754, who bestowed on Pope Stephen II (III) the exarchates of Ravenna and the Pentapolis which the Lombards, against whom Stephen II solicited Pepin's assistance, had taken from the Exarchate of Ravenna. Charlemagne confirmed this grant in 774, and in return received the title of Roman emperor from Leo III in 800. The wise policy of the popes in conferring favors on the Normans in Lower Italy secured to them in these vassals staunch protectors of the holy see. The structure of the papal power was fully completed during the tenure of Gregory VII. The dominions of Countess Matilda of Tuscany were added to the states of the church by her request in 1115, and the popes maintained possession of them against all the claims of the German emperors. The papacy removed a dangerous neighbor belonging to the house of Hohenstaufen by raising the house of Anjou to the throne of Lower Italy in the year 1265. The frequent revolutions of the Romans and the influence of the French led the popes of the 14th century to transfer their residence from 1309 until 1377 to Avignon, which Clement VI bought of Joanna I, queen of Naples and countess of Provence, in 1348. As this change of residence was made—it was charged under the influence of the king of France—it never obtained the full assent of the Romans and Germans, and antipopes were sometimes elected by the opposing factions, and the welfare of the church as well as of the Papal States suffered by their mutual hostilities. After 68 years of exile the popes returned to Rome. Julius II added Bologna to the papal dominions and forced

the Venetians to restore Ravenna, Cervia, Faenza, and Rimini. He was also instrumental in procuring Parma, Reggio, and Modena, although the latter two were restored to private hands in 1515. Ferrara was also recovered from Modena in 1597, and Urbino was bequeathed to the papal chair in 1626 by its last duke, Francesco Maria della Rovere. The wise administration of Sixtus V restored internal order toward the end of the 16th century, but the extravagance and family partialities of some of his successors created fresh disorder. Subsequently Naples renounced her feudal obligations to the papal chair.

After the successes of the French in Italy Pius VI was forced at the Peace of Tolentino (1797) to cede Avignon to France, and Romagna, Bologna, and Ferrara to the Cisalpine Republic in 1798. Then Pius VI was imprisoned and died in France. The victories of the Russians and Austrians in Italy favored the election of Pope Pius VII in 1800 who, under the protection of Austrian troops, took possession of Rome. By the concordat concluded in 1801 with the first consul of the French Republic, the pope precariously regained part of his temporal dominions. In 1807 France again declared war, and the provinces of Ancona, Urbino, Macerata, and Camerino were added to the kingdom of Italy. The possessions of the church beyond the Apennines were all that remained to the pope. On Feb. 2, 1808, a French corps of 8,000 men entered Rome; the remainder of the papal states were added to France and an annual pension of 2,000,000 francs settled on the pope, whose ecclesiastical power was guaranteed by Napoleon. The decree of May 17, 1809, put an end for the time being to the ecclesiastical state. The pope was held a prisoner in France until the events of 1814 again permitted him to take possession of his states the following year.

Pius VII was succeeded by Leo XII, who reigned from 1823 until 1829. He was succeeded by Pius VIII who, in his turn was succeeded by Gregory XVI in 1831 and Pius IX in 1846. The first acts of this pope were characterized by such a liberal spirit that diplomatic Europe was surprised. The events of 1848 caused the pope to pause in his advanced policy, which so dissatisfied the extreme liberal party that they drove Pius IX from Rome, and the reins of government fell into the hands of Giuseppe Garibaldi and Giuseppe Mazzini (1849) of the Roman Republic. Some few months afterward the French government, resolving to restore the papal authority, sent Gen. Nicholas C. V. Oudinot with an army against Rome. Defeated in their first attack on the city, the French began a siege in regular form and in a month's time were masters of it. Pope Pius did not return to Rome, however, until the following year.

After the Austro-Italian War of 1859, the papal see was stripped of the greatest part of its territorial possessions. Embracing before that date an area of 16,000 square miles, with 3,124,758 inhabitants, the Roman territory was then reduced to 4,891 square miles, and 692,106 inhabitants. Of the former legations and delegations into which it was subdivided only five remained—namely Rome and the Comarca, Viterbo, Civit  Vecchia, Velletri and Frosinone. From 1860 to 1866 the papal government was sustained by the presence of a French Army, which was withdrawn in 1866 upon the king of Italy binding himself by treaty to respect the integrity of the Roman states. In 1867, however, revolutionists

numbering 15,000, belonging to the Italian party of action, entered the papal territory, headed by Menotti Garibaldi. They made but little progress until the elder Garibaldi placed himself at their head. Napoleon III, at the earnest prayer of the pope, sent an army to protect the city against the violence of the revolutionists, who had now surrounded it. On October 28, the French entered Rome, and Garibaldi, beginning to perceive that he would be hemmed in by the regular Italian forces under Enrico Cialdini, thought of retreating. An advanced section of the papal troops came in contact with the Garibaldians (November 3), and were likely to have suffered severely had not two French battalions come speedily to their aid. Garibaldi, with 4,000 men, retreated into the Italian territory, where they were disarmed. A strong force of French troops were left in occupation of Civit  Vecchia after peace was restored and the pope seemed as secure as ever. But the outbreak of the Franco-German War changed the aspect of affairs. The French army of occupation left Rome on July 20, 1870, and the pope was at the mercy of his powerful neighbor, Victor Emmanuel II, king of Italy, who, seizing the opportunity, marched upon Rome and took it by force of arms. In September the Italian troops occupied Rome. In October the states of the church were incorporated with the kingdom of Italy, a plebiscite was held under bayonet rule, the count of which resulted in 133,681 in favor of the Sardinian occupation and 1,807 against it. In the beginning of July 1871, Rome became the seat of the Italian government and the residence of the court. An Italian law of May 13, 1871, guaranteed, besides possession of the Vatican and Lateran palaces and the villa of Castel Gandolfo, an annual income to His Holiness the Pope and his successors forever of 3,225,000 francs. The Lateran Treaty of 1929 settled the Roman question. Vatican City was created as a separate state, with full temporal power of the papacy together with adjustment of financial differences.

CHURCHES OF CHRIST. Though these churches are all free and independent of any general hierarchy, each local congregation having elders to oversee its affairs and deacons to assist them, yet they are united in a common faith and voluntarily cooperate in sending missionaries and in doing benevolent work under the direction of local churches. Membership depends only on (1) faith in and confession of Jesus Christ as the Son of God; (2) repentance from sin; (3) baptism by immersion. Their worship consists of the five acts specifically authorized by the New Testament: (1) reading and preaching the Bible; (2) observing the Lord's Supper as a memorial; (3) contributing money to the Lord's work; (4) praying; (5) singing (*a cappella*) psalms, hymns, and spiritual songs.

In faith and practice they date back to the founding of the church of the New Testament on the first Pentecost after Jesus' resurrection. They call for a complete return to the New Testament, and seek to restore in their worship, organization, and life the pattern of New Testament Christianity. Rejecting all party names, creeds, and organizations in their abhorrence of divisional denominationalism in Christendom, they plead for unity of all believers on the basis of the Bible alone.

The very nature of this fellowship of free

Christians makes it impossible to trace without interruption specific groups back to the day of Pentecost. It is known that during the 17th century there were Churches of Christ in England. Late in the 18th century a restoration movement swept over the United States and resulted in a rapid growth of such churches. In at least six different sections of the new nation men independently began to preach a return to the Bible, urging their hearers to become Christians only, and not to affiliate with any sect. In 1860 these churches counted 192,323 members; by 1875 there were some 400,000 members. In the last quarter of the 19th century there came a division. The tide of liberalism, later known as modernism, began to sweep many leaders away from a fundamental faith in the New Testament as an all-sufficient guide in matters of faith and practice. The simplicity of both the organization and the worship of many churches was changed by the institution of an overall missionary society to control the mission work of the brotherhood and by the introduction of mechanical instruments of music into the worship. These innovations were followed by open membership, modernistic theology, clericalism, and ecclesiasticism. The fundamental difference developed in the attitude toward the Bible as divine authority. A majority of the churches digressed from the original position and formed the denomination of the Disciples of Christ (q.v.). By 1906 this division was complete and was recognized by the Bureau of the Census.

CHURCHILL, Charles, English satirist: b. Westminster, England, Feb. 1731; d. Boulogne, France, Nov. 4, 1764. Achieving a measure of fame as a satirist during the last four years of his life that outweighed even that of such contemporaries as Samuel Johnson, Tobias Smollett, and William Hogarth, the elephantine figure of Churchill has faded almost to obscurity in the 20th century, his satires becoming mere historically interesting commentaries on 18th century mores in England.

The son of an English rector, Churchill was denied entrance to Cambridge University (some say because of his marriage at 17 years of age) and, after living in northern England and London in various stages of poverty, was ordained a priest in 1756, obtaining an ill-paid curacy that year in Essex. Two years later he was offered his father's curacy in Westminster and lived there for three years in obscurity. He wrote his first satires there but was unsuccessful in getting them published.

In 1761 he published at his own expense *Rosciad*, a satirical attack on contemporary actors that soon swept the country and rocketed him to fame. His next satire, *Apology Addressed to the Critical Reviewers* (1761), was an attack on Smollett, who had bitterly criticized *Rosciad* in his *Critical Review*, and again on contemporary actors, this time including David Garrick and prompting the latter to write Churchill's friend, Robert Lloyd, praising Churchill and attempting to cultivate his acquaintance.

Churchill was soon able to pay off all his debts and lived thereafter in such high fashion that his parishioners objected and forced him to resign his curacy in 1763.

In 1762 he became friends with the great political reformer, John Wilkes, and regularly contributed articles to his review, the *North Briton*,

an anti-Bute publication. In 1763 Churchill came out with a series of satirical verses: *The Prophecy of Famine*, an anti-Scottish poem severely condemned by Boswell; *An Epistle to Hogarth*, attacking the great caricaturist's cartoon of Wilkes; *The Duellist*, a defense of Wilkes and a bitter satire of Wilkes' enemies, the earl of Sandwich, William Warburton, and the earl of Mansfield; *The Ghost*, ridiculing Johnson's Cock Lane story. His publications in 1764 put forth his political tenures in *Gotham*, considered by many as his best piece; continued his satirical attack on the enemies of Wilkes in *The Candidate*; and prophesied his own death in *The Farewell*.

His other works were *Night* (1762); *The Conference* (1763); *The Author* (1763); *The Times* (1764); *Independence* (1764), noted for his portrait of himself; and *The Journey* (published posthumously). He died of fever on his way to meet the exiled Wilkes.

CHURCHILL, LORD Randolph Henry Spencer, English statesman, 3d son of the 7th Duke of Marlborough: b. Feb. 13, 1849; d. London, Jan. 24, 1895. He was educated at Merton College, Oxford, and entered Parliament in 1874 as member for Woodstock. After the Conservative debacle in 1880, he formed what was half satirically known as the Fourth Party, consisting usually of four members, who took up an attitude of uncompromising and even obstructive opposition to the measures of government, and one also of frank and brutal criticism of the "old gang," as Lord Randolph called the official opposition leaders. So well did he employ his powers of ready and extensive criticism, both in the House and in the country, that on the accession of the Conservatives to office in 1885, he became secretary for India. His tenure of this office was rendered notable by the annexation of Upper Burma. On the defeat of Gladstone's Home Rule bill in 1886 and the return of the Unionist Party to power, Churchill became leader of the House of Commons and chancellor of the exchequer. In his leadership of the House he showed tact, judgment, and resource; but on December 23, of the same year, owing to demands made by the ministers responsible for the army and navy for increased outlays, to which he was opposed, he caused a sensation by unexpectedly resigning office. Subsequent events showed this to be an act of political suicide, for he never regained his old place in the party councils. A man of great natural abilities, and of boundless ambition, with marvelous political insight and debating and oratorical talent of a high order, he had at the same time the defects inseparable from an unstable nervous system. In 1874 he married Jennie Jerome, a daughter of Leonard Jerome, of New York. In July 1900, Lady Randolph Churchill married George Cornwallis West. She died June 29, 1921. His elder son, Winston Leonard Spencer Churchill (q.v.), inherited his father's political abilities.

CHURCHILL, William, American philologist: b. Brooklyn, Oct. 5, 1859; d. Washington, D.C., June 9, 1920. Graduated at Yale in 1882. In 1896 he became consul general to Samoa, also judge of the consular court and receiver and custodian of the revenues of Samoa. In 1897 he was also made consul general to Tonga. In 1902-1915 he was a member of the editorial staff of the *New York Sun*. He edited the *Malayo-Poly-*

nesian department of the *Standard Dictionary* in 1912. He was a fellow of the Royal Anthropological Institute and of the American Philological Association. He wrote *A Princess of Fiji* (1892); *Polynesian Wanderings* (1910); *Beach-la-Mar* (1911); *Easter Island, Rapanui Speech and the Peopling of Southeast Polynesia* (1912); and *The Subanu* with John Parke Finley (1913).

CHURCHILL, Winston, American novelist: b. St. Louis, Mo., Nov. 10, 1871; d. Winter Park, Fla., March 12, 1947. He was educated in the public schools of St. Louis and at the United States Naval Academy, Annapolis, and graduated from the latter institution in 1894. He was a member of the New Hampshire legislature, 1903-1905, and was a candidate on the Progressive ticket for governor of New Hampshire in 1912, but failed of election. He wrote several successful novels and many articles for magazines. His novels include *The Celebrity* (1898); *Richard Carvel* (1899); *The Crisis* (1901); *The Crossing* (1904); *Comiston* (1906); *Mr. Crove's Career* (1908); *A Modern Chronicle* (1910); *The Inside of the Cup* (1913); *A Far Country* (1915); *The Dwelling Place of Light* (1917); and *The Uncharted Way* (1940).

CHURCHILL, Sir Winston Leonard Spencer, British statesman and man of letters: b. Blenheim Palace, Oxfordshire, Nov. 30, 1874. He was the elder son of Lord Randolph Henry Spencer Churchill and Jennie (born in Brooklyn, N. Y., in 1850), daughter of Leonard Jerome, owner of the New York *Times* and a banker. His love of soldiering as a young man, and the sound strategical concepts he displayed in later years, were traits which he had in common with his great ancestor John Churchill, 1st duke of Marlborough. A man of many parts, with a great zest for life, he was an ardent polo player in his youth, learned to pilot an airplane, took out a union card as a qualified bricklayer, and in later years developed considerable skill as a landscape painter. The talent he showed in so many fields reached its height in his long career in politics. His mastery in debate, his brilliance as an orator, his independence, rank him among the greatest figures in British history. In his speeches, so carefully prepared and rehearsed, and in his forceful and lucid writings, he exhibits a command of the English language that has seldom been equalled.

After attending Harrow, where he coupled a conspicuous distaste for Latin with an early enthusiasm for his own language, he was admitted to Sandhurst Military Academy (the British "West Point") at the third attempt, and on being commissioned in 1895 he was gazetted to the 4th Hussars. The same year, while on leave, he visited Cuba as an observer in the Spanish campaign against the guerrillas, and in 1896 he obtained a transfer to the Indian Army. In India he studied philosophy, history, and economics, and during 1897, as an officer in the 31st Punjab Infantry, he served on the Northwest frontier in the Malakand and Tirah operations. On these campaigns he was war correspondent for the Allahabad *Pioneer* and the London *Daily Telegraph*, and from this experience came the first of his numerous books, *The Story of the Malakand Field Force* (1898), a best seller, in which he dared to criticize his superior officers. *Savrola*, his undistinguished and

only attempt at fiction, was serialized by *Macmillan's Magazine*, and appeared in book form in 1900. Sir Herbert (later Lord) Kitchener accepted him with reluctance in 1898 for service in the Egyptian campaign for reconquest of the Sudan; riding with the 21st Lancers in the battle for Omdurman, he participated in one of history's last classic cavalry charges. He reported the campaign for the London *Morning Post*, and later recorded it in *The River War* (1899), another highly critical, though accurate, work. Deciding to abandon army life for politics, in 1899 he contested the Oldham parliamentary division as a Conservative; and after failing to win the seat, he sailed for Cape Town, to report the South African War for the *Morning Post* at the highest salary yet paid to a war correspondent.

When an armored train in which he was riding in November 1899, two weeks after arrival, was ambushed by the Boers in Natal, he helped in the defense and was taken prisoner by Louis Botha—who later, and largely with the support of Churchill, became the first premier of the Union of South Africa. Because of Boer clemency he was not shot for exceeding the functions of a journalist, but was imprisoned at Pretoria, whence he escaped within a month with a price on his head. Making his way across Portuguese East Africa, he reached Durban, in Natal, where he was commissioned lieutenant in the South African Light Horse; he saw a good deal of the subsequent fighting up to the capture of Pretoria, where he helped release his erstwhile fellow prisoners. He gave an account of his experiences in *London to Ladysmith via Pretoria* (1900) and *Ian Hamilton's March* (1900).

Back in England before the end of 1900, he stood once again as parliamentary candidate at Oldham, on this occasion successfully. Soon, in the House of Commons, he assailed the policies of the Conservative government under whose banner he was supposed to be serving, opposed increases in the army, and urged leniency to the Boers. The tariff reform proposals of Joseph Chamberlain in 1903 met with his uncompromising opposition, and over this issue he left his party in the summer of 1904. At the early age of 31 he obtained his first ministerial post, the minor one of undersecretary of state for the colonies, in the Liberal administration formed in 1905 by Sir Henry Campbell-Bannerman. At the ensuing general election he was returned to Parliament by the Northwest Manchester division, and since his chief, the 9th earl of Elgin, was seated in the Lords, he became the spokesman for his party in the Commons. His ability in piloting legislation to transform the Transvaal and Orange Free State into British colonies presaged the brilliant future that lay ahead. The year 1906 saw publication of his life of *Lord Randolph Churchill*, an authoritative 2-volume biography by an admiring son; and in *My African Journey* (1908) he recorded a tour through East Africa from Mombasa to the Sudan by way of Uganda.

In 1908, now 33 years old, he became president of the Board of Trade in the cabinet reconstructed by Herbert Asquith; in that year, too, he married Clementine Ogilvy Hozier, "and," as he later confessed, "lived happily ever afterwards"; they were to have a son and four daughters. Repudiated at Northwest Manchester, he was elected by the voters of Dundee, and now he showed his interest in social legislation by

sponsoring labor exchanges and helping to create unemployment insurance. For his support of the budget of David Lloyd George imposing much additional taxation, he was denounced as a traitor to the wealthy class to which he belonged. Transferred to the cabinet post of home secretary in 1910, he reduced or cancelled numerous prison sentences and sought to ameliorate the rigors of imprisonment. Attacks were made upon him in Parliament and the press for his part in the "battle of Sidney Street," a siege of foreign criminals in a London slum on Jan. 3, 1911. Before he left the Home Office, he secured passage of bills setting up a minimum wage in certain sweated industries, limiting hours of work in shops, and protecting coal miners.

Disagreement between army and navy heads as to the strategy to be adopted in event of war, and the aspirations of Kaiser Wilhelm II for "a place in the sun," clearly indicated in 1911 the need for a strong man at the Admiralty. Churchill was the obvious choice for first lord, and as soon as he assumed his duties he planned a great increase in naval strength; before long, too, he created the navy's first air service. In July 1914, acting entirely on his own responsibility, he forbade dispersal of the fleet after a royal review off Spithead, with the result that, when hostilities commenced two weeks later, the British Navy was already fully mobilized. He personally accompanied a British naval landing force to Antwerp the following October, and though it failed to defend the city, the German advance was slowed and the Channel ports were thus saved. The Dardanelles campaign of 1915, for which Churchill had pressed, proved a blunder because of the inadequacy of others; a public quarrel with Admiral Lord (John Arbuthnot) Fisher and a cabinet crisis followed. With the formation of a Coalition government Churchill was ousted from the Admiralty, and in November 1915, after a short tenure of the minor cabinet post of chancellor of the duchy of Lancaster, he resigned.

Forthwith he went to the western front as a major in the 2d Grenadier Guards, and then was given command of the 6th Royal Scots Fusiliers with the rank of lieutenant colonel. He resumed his seat in the House of Commons in the autumn of 1916, and the next year succeeded Lloyd George, then prime minister, as minister of munitions. In 1915, while at the Admiralty, he had been one of the first to encourage development of the tank, and now he put an improved model into large-scale production; German Gen. Erich Ludendorff is authority for the statement that in no small measure the tank decided the later course of World War I.

In the reorganized Coalition cabinet of 1919 he was made secretary for war and air minister, and soon was widely denounced for bolstering up the White Russians in their futile struggles against the Bolsheviks. Appointed colonial secretary in 1921, his main preoccupation was with the many problems of the Middle East; and he also participated in the negotiations resulting in establishment of the Irish Free State. He went into temporary retirement when repudiated by the Dundee electors in the 1922 general election. During this period he turned once more to writing, preparing the first installments of *The World Crisis* (1923-1929), a colorful 5-volume record of World War I in which he strongly de-

nounced the costly strategy employed on the western front.

When Churchill again entered the political arena, in 1924, he offered himself as an independent anti-Socialist, attacking the Labour Party which had by now supplanted the Liberals as senior opposition to the Conservative government. Unsuccessful in the Westminster Abbey parliamentary division, he secured election at Epping, once more as a Conservative after an absence from the party of nearly 20 years. He was appointed chancellor of the exchequer in the cabinet of Stanley Baldwin, and presented to Parliament five successive annual budgets; in the first, he returned Britain to the gold standard, a step that proved ultimately disastrous and precipitated the general strike of 1926.

The advent of the Labour Party to office in 1929 left him once more without a ministerial post, though still with a seat in the House. He made a lecture tour in the United States in 1930, traveled much in Europe, and again took up his pen. In rapid succession he published *My Early Life* (1930; New York ed., *A Roving Commission*, 1941), a lightly written autobiography; *The Eastern Front* (1931), a supplement to *The World Crisis*; and *Thoughts and Adventures* (1932), a pleasant miscellany. These were followed by the four-volume *Marlborough, His Life and Times* (1933-1938), a powerful vindication of his hero; the well-informed *Great Contemporaries* (1937); *Arms and the Covenant* (1938), a volume of speeches; and *Step by Step* (1939), a collection of his newspaper articles.

As early as 1932 he was warning his countrymen against the resurgent might of Germany, but his voice was unheeded by a Britain which trusted that appeasement would mollify Adolf Hitler. Averse to changes in British constitutional affairs, he fought the Government of India bill of 1935 giving a more liberal measure of self-government to that country; in 1936 he was the one man of public fame to defend Edward VIII when confronted with the choice between a wife of his own choosing and the crown; and in 1937 he assailed the release of the British naval ports in southern Ireland to Eamon de Valera. Although these denunciations of Conservative policies effectively debarred him from a cabinet post, he was not to be intimidated—and in some matters time was to bring his justification.

With Britain and France humbled by the German annexation of Austria and the partition of Czechoslovakia, public opinion rallied behind Churchill, and when war was declared on Germany, Sept. 3, 1939, he was the country's instinctive choice for first lord of the admiralty. Resuming the post he had occupied when World War I broke out a quarter of a century earlier, he inspired the nation with such confidence that, on April 4, 1940, he was given supreme administrative command of all naval, military, and air forces. On May 10, as German troops poured into the Low Countries, he succeeded Neville Chamberlain as prime minister and assumed the added post of minister of defence. "I have nothing to offer but blood, toil, tears and sweat," he told the House of Commons. "... You ask, what is our policy? I will say: It is to wage war, by sea, land, and air, with all our might and with all the strength that God can give us. ... You ask, What is our aim? I can answer in one word—Victory."

The career of Churchill in the war years

that followed epitomizes the history of Britain. In 1940, while stirring the nation to immense efforts to avert invasion, he took the momentous decision to send to Egypt Britain's sole remaining armored division—so that the highway to Asia might be preserved. With German submarines sinking much British shipping, in 1941 he procured from the United States 50 over-age destroyers in exchange for leased bases in the British West Indies. When demands for a second front in western Europe became insistent in 1942, he convinced the Russians that such a course, if taken prematurely, might end in a disaster which would delay German defeat for many years. None gave more enthusiastic support than he to the Allied plans for landing in North Africa in 1942 and in Normandy 18 months later.

In loyalty to Britain's allies he was unwavering. When France was defeated and about to seek an armistice with Germany, he appealed to her to hold fast, even suggesting an amalgamation of the two states, with a common citizenship and joint organs of government, by means of a solemn act of union. Nor did he lose hope for her: "Never will I believe that the soul of France is dead. Never will I believe that her place among the greatest nations of the world has been lost for ever!" Such faith was demonstrated in the continued support he gave to Gen. Charles de Gaulle, unchanged even when the British Navy sank French warships anchored at Oran: "I leave the judgment of our action, with confidence, to Parliament. I leave it to the nation, and I leave it to the United States. I leave it to the world and history." Despite this friendship, however, he sent de Gaulle a peremptory request in May 1945 to cease fighting the young Levantine republics.

For 20 years an avowed enemy of the Soviet regime, he set aside old animosities when the Germans invaded Russia in 1941: "Any man or state who fights on against Nazidom will have our aid. Any man or state who marches with Hitler is our foe." Twice Churchill flew to Moscow to meet Marshal Stalin, and with President Franklin D. Roosevelt he conferred with Stalin at Teheran and at Yalta. Churchill was also responsible for the ratification in 1942 of a 20-year treaty of friendship between Russia and Great Britain. He was on terms of close friendship with President Roosevelt from the time they met off the Newfoundland coast to draft the Atlantic Charter, August 1941. At Washington, in December of that year, they set up a Combined Chiefs of Staff organization for joint direction of the war; and before a joint session of Congress Churchill avowed his "hope and faith, sure and inviolate, that in the days to come the British and American peoples will for their own safety and for the good of all walk together side by side in majesty, in justice, and in peace." He visited the United States again the following June, and in 1943 and 1944 after conferences at Quebec. He met President Roosevelt in North Africa at the close of 1942, and a year later, at Cairo, the two leaders conferred with Chiang Kai-shek and President İnönü of Turkey.

Despite the fact that, as premier, Winston Churchill traveled 150,000 miles by air to visit the fighting fronts, and to confer with Allies and neutral nations, he never lost contact with domestic affairs. While departmental matters were handled by members of his Coalition cabinet, he guided much of the postwar planning. In

March 1943 he put forward a 4-year plan for reconstruction after conclusion of hostilities, and the next year sponsored numerous proposals for domestic reform: an enlarged social insurance plan, extending that which he, as a Liberal, had introduced 30 years earlier; health services which were to be freely available to everybody; and a partnership of the state with private enterprise to restore the export industries without which Britain could not survive.

It was in the war years, perhaps, that his rich and colorful oratory reached its heights, though his speeches sometimes lacked measure, he used too many adjectives, and he constantly interrupted the evolution of his theme to catch some image or some phrase which had glittered at him from the outskirts of his mind. Nevertheless the benches were packed when he spoke in the House, the sound of his voice varying in tone from lusty recital to half-humorous comment; and for his memorable broadcasts he had all the world for an audience. After the remnants of the British Army had been evacuated from Dunkirk, he promised Parliament: "... we shall fight on the beaches, we shall fight in the fields and in the streets, we shall fight in the hills; we shall never surrender"; and two weeks later: "Let us therefore brace ourselves to our duties, and so bear ourselves that, if the British Empire and its Commonwealth last for a thousand years, men will say, 'This was their finest hour.'" During the Battle of Britain he paid tribute to the Royal Air Force: "Never in the field of human conflict was so much owed by so many to so few." When suggestions came from across the Atlantic in 1942 as to the future status of dependent peoples, he warned: "We mean to hold our own . . . I have not become the King's First Minister in order to preside over the liquidation of the British Empire." At Harvard, on receiving an honorary degree in 1943, he said: "Let all of us who are here remember that we are on the stage of history, and that whatever our station may be, whatever part we have to play, great or small, our conduct is liable to be scrutinized not only by history but by our own descendants."

He led his country through nearly six years of war against Germany, yet, despite his proven record as a war leader, he and his Conservative Party were repudiated by the voters before the peace had been made, Labour winning a decisive victory at the general election in July 1945. Although he retained his seat in the House of Commons, Churchill vacated the premiership in favor of Clement Richard Attlee, and in a valedictory expressed his profound gratitude to the British people for the kindness "shown toward their servant."

In addition to leading the Opposition in Parliament, Churchill turned once more to writing, recording his memoirs of World War II in a succession of notable volumes under the general title *The Second World War: The Gathering Storm* (1948); *Their Finest Hour* (1949); *The Grand Alliance*; *The Hinge of Fate* (both volumes published in 1950); *Closing the Ring* (1951); and *Triumph and Tragedy* (1953). In the general election of October 1951 he led his Conservatives to a slim Parliamentary majority, and as prime minister, he acclaimed the accession of Queen Elizabeth II in 1952: "I, whose youth was passed in the august, unchallenged, and tranquil glories of the Victorian era, may well feel

a thrill in invoking once more the prayer of the anthem—*God Save the Queen!*" It was as prime minister and newly created Knight of the Garter (April 1953) that he attended the coronation, wearing the great Garter badge of his ancestor, the 1st duke of Marlborough.

In the later years of his life, his interests proved no less varied than in his youth, and the honors bestowed upon him demonstrated the esteem in which the free world held him. In an exhibition at the Royal Academy in May 1953, Sir Winston was represented by five canvases, all of which were praised by the critics. In the following month he established a foundation for cultural exchange between Great Britain and Denmark. The original endowment had been presented to him by the people of Denmark as a demonstration of their gratitude when he received an honorary doctorate of philosophy at the University of Copenhagen in 1950.

Sir Winston's often expressed belief in the efficacy of personal contact between heads of state was again illustrated when, in January 1953, he journeyed to Washington to hold talks with both the outgoing and the incoming administrations. At the same time he visited Canada to confer with officials there on several problems, including Southeast Asia. Later in the same year (December 1953) he attended a conference in Bermuda between the heads of governments of Great Britain, France, and the United States.

In October 1953, a month before his 79th birthday, Sir Winston received the Nobel Prize for Literature. He resigned as prime minister on April 5, 1955.

WHEELER B. PRESTON.

CHURCHILL, river, Canada, rising in Lake la Loche, Saskatchewan Province, and flowing for about 1,000 miles east and northeast across Manitoba to enter Hudson Bay at Churchill. The largest of numerous lakes through which it passes are the Churchill and Snake in Saskatchewan, and the Granville and Southern Indian in Manitoba. Its chief tributaries are the Reindeer and the Beaver.

CHURCHING OF WOMEN, a rite founded on the Mosaic injunction given in Leviticus 12:6-8. As now practiced in some denominations, it is a giving of thanks for the birth of a child. The first mention of the subject as a usage in the Christian Church is found in the pseudo-Nicene Arabic Canon, but no prescribed form is given.

CHURCHYARD, *chŭrch'ĕrd*, Thomas, English poet and miscellaneous writer: b. Shrewsbury, about 1520; d. London, April 4, 1604. From 1541, Churchyard fought as a soldier of fortune in many campaigns in France, the Low Countries, Ireland, and Scotland. After 1560 he poured forth a great number of broadsides, pamphlets, and larger works, and was frequently employed to supply verses for court masques and pageants. His *Churchyard's Choise* (1579) proved offensive to Queen Elizabeth and he was forced to take refuge in Scotland for three years. He wrote *The Legend of Shore's Wife* in *The Mirror for Magistrates* (1563), a publication prepared by William Baldwin; *The Worthiness of Wales* (1587), and various autobiographical pieces. In *Colin Clouts Come Home Again* (1595), the eclogue by Edmund Spenser, he was styled "Old Palaemon."

CHURL (Saxon *ceorl*), in modern usage, a rude, boorish person, but in Saxon England the term denoted a common freeman. The rank of churl, or *ceorl*, steadily declined until finally the only important distinction between churl and serf was that the former might choose his own master. The better class of churls sometimes found their way into the class of theynes, or thanes, corresponding to the knights of post-Conquest times, while the others became the villeins of the Norman feudal organization. *Doomsday Book* (*Domesday Book*, q.v.) makes no mention of the word *ceorl*.

CHURN, a container in which milk or cream is stirred or beaten to separate its oily globules in a solid mass from the fluid portions, and thereby to obtain butter. Churns are of two principal types. The cylindrical, barrel-shaped type is rotated end-over-end while a paddle on the inside stirs the milk or cream; it is equipped with a valve to allow the escape of gas formed during the process of butter making, and a faucet to allow the buttermilk to be drained off. The fixed type remains stationary while the beaters, attached to a rod passing through the center of the container, are rotated by motor power. The churns commonly used by early American housewives, and still used occasionally on farms by families who wish to make their own butter, consist of a hardwood barrel with a straight rod projecting downward through the cover and attached below to the dasher. By plunging the rod up and down vigorously, butter could be manufactured in about 45 minutes. The small quantity of butter thus produced, however, and the strenuous effort required by this hand process, eventually led to the invention of the large motor-driven churns of modern times which are capable of producing large quantities of excellent butter in a short time. See also BUTTER; DAIRY PRODUCTS.

CHURRIGUERESQUE, *chōō-rĕ-gā-rĕsk'*, the term used to describe that distinctively Spanish post-Renaissance style in architecture which combines the baroque and the rococo. It takes its name from José Churriguera (c.1650-1725) who was royal architect in the reign of Charles II and through his two sons and his pupils dominated Spanish architecture in the first half of the 18th century. Its most striking and unrestrained development was in Mexico. See also MEXICO—Architecture.

CHURRUS, *chŭr'ŭs*, or **CHARAS**, *chŭr'ās*, the resinous exudation of the leaves and flowers of Indian hemp, *Cannabis indica*. It is used by the natives of India as an intoxicating drug. See also HASHISH; HEMP.

CHURUBUSCO, *Battle of*, *chōō-rōō-bōōs'kō*, one of the principal engagements of the Mexican War, took place Aug. 20, 1847. Contreras (q.v.) was won in the early morning. Churubusco in the forenoon and early afternoon of that day, but they are quite distinct battles. Gen. Winfield Scott was in command of the American forces. The main road north to the City of Mexico, via San Agustín and San Antonio, an elevated paved causeway, converged with that on the west from Contreras and Coyoacán at Churubusco, a village six miles south of the capital and a mile northeast of Coyoacán. Just

north of it ran east and west the little stream called Río Churubusco, crossed by the main road at a bridge fortified with a bridgehead. In the western part of the village, southwest of the bridgehead, on the Coyoacán road, was the Convent of San Pablo, a massive building with walls so thick that fieldpieces could make no impression on them, defended on two sides by strongly built bastions.

The two points to be carried were the convent and the bridgehead. The Mexican commander, Gen. Antonio López de Santa Anna, threw a battalion into the convent, placed five guns and a heavy body of troops at the bridgehead, and posted several regiments along the north bank of the stream. The first American assault was made on the convent when the brigades of Gen. Benney Riley and Gen. Persifor F. Smith attacked it from the west and south. Seizing a line of adobe buildings 60 yards from the convent, they opened fire under that protection and held it until the time for advance. Meantime the division of Gen. William Jenkins Worth, with the forces of Gen. Gideon Johnson Pillow and others, had charged down the causeway, blocked for several hundred yards with loaded wagons, and through the fields to the bridgehead. They were twice repulsed with tremendous loss by the plunging fire of the Mexican guns; but Gen. James Shields had moved north from Coyoacán and, after a fierce combat, which nearly overwhelmed him, he was reinforced by Capt. Robert E. Lee and Maj. Edwin Vose Sumner, carried the river line, and moved east against the rear of the bridge. In danger of having their retreat from the capital cut off, the Mexicans lost nerve, and a third charge from the Americans carried the bridgehead with a rush. Thence they turned southwest against the convent; the American artillery was still battering it on the other side; a sally from the garrison was driven back and, as the fire slackened, both divisions of the Americans entered it from opposite sides at the same time.

The American forces in this battle numbered a little over 7,300; the Mexican numbers are uncertain, but were probably about 25,000. The American losses at Contreras and Churubusco together were 1,053, over 100 at Contreras alone. Mexican casualties were 2,637 prisoners at both, and probably 2,000 at least killed and wounded at Churubusco. See also CONTRERAS, BATTLE OF.

Consult Bancroft, H. H., *History of Mexico* (San Francisco 1885); Scott, General Winfield, *Autobiography* (New York 1864); Wilcox, C. M., *History of the Mexican War* (Washington 1892); Smith, Justin H., *The War with Mexico*, 2 vols. (New York 1919); Henry, R. S., *Story of the Mexican War* (Indianapolis 1950).

CHUSAN, China. See CHU SHAN.

CHUSOVOI or **CHUSOVOY**, chō-sō-voi', city, USSR, located in the Russian Soviet Federated Socialist Republic and the central Urals, on the 480-mile Chusovaya River, about 55 miles east-northeast of Molotov. A rail center, it has important heavy industries (steel and pig iron). The city was founded in 1879. Pop. (est. 1933) 41,620.

CHUTNEY, chūt'ni (from Hindustani *catni*), a condiment compounded of sweets and acids, much used in the East Indies and thence introduced into England and other countries. Ripe fruit, especially mango and tamarinds, raisins, spices, herbs, chilies or cayenne, lemon juice, and vinegar, are the ordinary components, which are pounded, well boiled together, and then bottled for use. It is often served with curried dishes.

CHUVASH AUTONOMOUS SOVIET SOCIALIST REPUBLIC, chō-vāsh', USSR, administrative division in the Russian Soviet Federated Socialist Republic, south of the Mari ASSR and in the mid-Volga Basin. Its capital is Cheboksary, a Volga port. The region is forested (largely oak), and timber industries furnish the most important products. Grain crops are extensive and the cultivation of kok-saghyz, a rubber-bearing plant, is gaining in prominence. Mineral resources include phosphorites. The climate is of the severe Continental type; the rivers are frozen during winter, and there is snow for five months of the year. The Chuvash, a Turkic-Tatar people, making up about 80 per cent of the entire population, are sometimes thought to be descendants of the ancient Bulgars. The republic was set up in 1925. It covers 7,100 square miles; pop. (est. 1941) 1,132,360.

CHUZZLEWIT, Martin, the principal character in Charles Dickens' novel *The Life and Adventures of Martin Chuzzlewit* which was originally published in monthly numbers from January 1843 to July 1844.

CHYLE, kil, a milky white emulsion of fat globules taken up by the lacteals from the intestines in the course of digestion. It resembles lymph, except in the fat content, and is alkaline in reaction. Chyle has a specific gravity of 1.0222 and contains on the average 6.8 per cent of solids, of which proteins constitute 3.64 per cent and fat 3 per cent, the remainder being made up of cholesterin, lecithin, and salts. Under some circumstances the fat content may be as high as 5 to 15 per cent. From the lacteals—lymphatic vessels in the small intestine—and deeper lymph channels, chyle is forced ultimately into the thoracic duct from where it is conveyed to the left subclavian and internal jugular veins. Thus chyle, with its nutritious elements, enters the blood stream and merges with it to nourish the body. See also CHYME; LACTEALS; and LYMPH.

CHYME, kim, the pulpy, semifluid contents of the stomach consisting of food which has undergone gastric digestion before passing into the duodenum. The mass is grayish in color and the previous texture or nature of the aliment can no longer be distinguished. It passes by the pylorus into the intestinal canal, where it is then mixed with the pancreatic juice and bile; parts of it are absorbed by the lacteals that transform it into chyle (q.v.). See also DIGESTION.

CIALDINI, chāl-dē'nē, Enrico, DUCA DI GAETA, Italian soldier and diplomat: b. Castelvetro, Modena, Italy, Aug. 10, 1811; d. Leghorn (Livorno), Italy, Sept. 8, 1892. For his share in the insurrection of 1831 he was forced to escape to France and in 1835, passing over to the Spanish service, he fought against the Carlists and was made colonel. In the Crimean War he commanded a division of the Sardinian contingent, and on his return was appointed aide-de-camp to the king. He was entrusted by Camillo Benso di Cavour, the Sardinian premier, with the forma-

tion of the famous army unit, Cacciatori delle Alpi. In the Italian War of 1859, the victory at Palestro was his chief exploit. In 1860 he defeated the papal army at Castelfidardo; and in 1861 Gaeta and Messina yielded to him. Created duke of Gaeta, and for a few months governor of Naples, he defeated Giuseppe Garibaldi at Aspromonte (1862) in the latter's attempt to secure Rome. In the war of 1866, he occupied Venice almost without a blow, but was defeated at Custoza. In 1876 he was sent as ambassador to Paris, but he retired in 1881 and received the post of one of the two generals of the Italian Army.

CIAMICIAN, chā-mê-chān', **Giacomo Luigi**, Italian chemist: b. Trieste (then in Austria), Aug. 22, 1857; d. Bologna, Italy, Jan. 2, 1922. Educated at the University of Vienna, he became assistant at the chemical institute of Rome in 1880 and in 1889 was appointed professor of general chemistry at Bologna. In 1910 he became a member of the Italian Senate. His latest studies were in the field of biological chemistry. His published works include *I problemi chimici del nuovo secolo* (1905); *Cooperazione delle scienze* (1911); and *Fotochimica nell'arvenire* (1912).

CIAMPI, chām'pē, **Ignazio**, Italian poet and historian: b. Rome, Italy, July 31, 1824; d. there, Jan. 21, 1880. From 1874 until his death he was professor of modern history in the University of Rome. His poetical works include an epic, *Stella* (1858), two volumes of *Poesie varie* (1857), and comedies, including *Il segretario e la contessa*. Ciampi wrote several works on the history of literature, also biographies, and histories of special periods. His principal work appeared posthumously: *Storia moderna dalla scoperta dell'America alla pace di Westfalia*, 2 vols. (1881-1883).

CIAMPI, **Sebastiano**, Italian scholar: b. Pistoia, Italy, Oct. 30, 1769; d. Florence, Dec. 14, 1847. Ordained as a priest in 1793, he was appointed professor at the University of Pisa in 1803; he accepted in 1818 a professorship at Warsaw and returned to Florence, Italy, in 1822, a prebend which enabled him to devote himself to literary studies having been conferred on him in Poland. His principal works treat of Italian literature and art, of ancient literature, of the Latin literature of the Middle Ages, and of the history of Poland.

CIANO, chā'nō, **CONTE Galeazzo** (in full, **CIANO DI CORTELLAZZO**), Italian foreign minister under Mussolini: b. Livorno, Italy, March 18, 1903; d. Verona, Jan. 11, 1944. With his father, Count Costanzo Ciano (1876-1939) he participated in the Fascist march on Rome in 1922. After law studies at the University of Rome, he engaged briefly in journalism, then in 1925 entered the diplomatic service, serving at Rio de Janeiro, Buenos Aires, and the Holy See. In 1930 he married Edda, oldest child of Mussolini, and was appointed consul general at Shanghai, later becoming minister to China. He returned to Italy in 1933 and the following year was made minister of press and propaganda. An enthusiastic amateur aviator, he commanded a bomber squadron in the war with Ethiopia (1935-1936). In June 1936, Mussolini appointed him foreign minister, although he was but 33 years old and

lacked both experience and temperamental aptitude for so important a post.

Ciano's relations with the Germans increasingly worsened during the period before Italy's declaration of war against France (June 1940); indeed, after the 1938 Anschluss he and von Ribbentrop were hardly on speaking terms, and he vainly attempted to prevent the signing of the Tripartite Treaty of May 1939 which bound Italy to the German juggernaut. On the eve of the war he commenced a diary which was published in a two-volume edition at Milan in 1946, after a translation had appeared in London (1945). This work reveals his humiliation at the arrogance shown by the Germans toward their Italian ally, and his futile attempts to prevent Mussolini from becoming still more subservient to Hitler. Relieved of his post on Feb. 5, 1943, he was made ambassador to the Holy See. In July he joined the dissident members of the Fascist Grand Council who forced Mussolini's resignation. Interned in Germany, he was delivered by the Germans to the Italian Fascists at Verona, tried by them for treason, and executed by a firing squad.

CIBAO, sê-vă'ô, valley, Dominican Republic, in the northern part of the country, forming its economically most important section and extending for about 150 miles east-southeast between the Cordillera Septentrional and the Cordillera Central. The latter range comprises the Cibao Mountains, which have a length of about 20 miles. In the Cibao are such towns as Monte Cristi (Montecristi), Santiago de los Caballeros, La Vega, and Sánchez. The fertile region produces tropical fruit, tobacco, coffee, cacao, sugarcane, and cereals. The valley's eastern portion is also called La Vega Real. When Columbus discovered the island, he was told by the natives that there was gold in the Cibao and he thought it to be a part of Marco Polo's Japan (Cipango).

CIBBER, sīb'ēr, or **CIBERT**, **Caius Gabriel**, Danish sculptor, father of Colley Cibber (q.v.): b. Flensburg, Denmark (now Schleswig-Holstein, Germany), 1630; d. London, England, 1700. Visiting England during the protectorate of Oliver Cromwell, he met with such encouragement as to induce him to settle there. The many works he was commissioned to execute include the bas-reliefs on the pedestal of the London Monument and ornaments for the gardens of Hampton Court. The sculptures, however, by which he is principally known are his figures of *Melancholy* and *Raving Madness*, formerly erected above the gate of the old Bethlehem Hospital and now in the Guildhall Museum.

Consult Faber, Harald, *Caius Gabriel Cibber* (New York 1926).

CIBBER, **Colley**, English dramatist and actor: b. London, England, Nov. 6, 1671; d. there, Dec. 12, 1757. A son of the Danish sculptor Caius Gabriel Cibber (q.v.), and the latter's second wife, Jane Colley, he made his appearance with Thomas Betterton's company at the Drury Lane Theatre in 1690. His first comedy, *Love's Last Shift, or the Fool in Fashion*, came out in 1696 and met with great success. He himself played the part of Sir Novelty Fashion, a fop. The character, also borrowed by Sir John Vanbrugh, is found in most of his plays, the roles of which he acted with similar distinction. Cibber's fame as dramatic author is founded chiefly on the

Careless Husband (1704), which even obtained the approbation of his declared enemy, Alexander Pope. This comedy, though without novelty in the characters and without invention in the plot, is a good picture of the manners and follies of the time. His play, the *Non-Juror*, an imitation of Molière's *Tartuffe*, adapted to English manners, was first performed in 1717 and was directed against the Jacobites. Though it was very successful, it made for him many enemies whose number he increased by his conduct as director of the Drury Lane Theatre, from 1711. His appointment as poet laureate in 1730 gave full play to the raillery of his enemies. Cibber, though not devoid of vanity, had the good sense to join in the laugh against his own verses. Pope, however, did not cease to ridicule him at every opportunity, particularly in *The Dunciad*. In 1740 Cibber published his *Apology for the Life of Mr. Colley Cibber, Comedian*, written with spirit and candor and containing many entertaining anecdotes and judicious remarks on the theater of that time.

Consult Habbema, D. M. E., *Appreciation of Colley Cibber*, . . . (Amsterdam 1928); Senior, F. D. P., *Life and Times of Colley Cibber* (New York 1928); and Barker, R. H., *Mr. Cibber of Drury Lane* (New York 1939).

CIBBER, Susannah Maria (Arne), English singer and actress: b. London, England, February 1714; d. there, Jan. 30, 1766. She was the sister of the celebrated Thomas Augustine Arne (composer of the music of *Rule Britannia*), who taught her music and introduced her in one of his operas at the Haymarket Theatre. She was a favorite of George Frederick Handel, who composed pieces expressly adapted to her voice and also instructed her in singing them. In 1734 she married Theophilus Cibber (q.v.), but soon after was separated from him. Subsequently she made her appearance in tragedy. Her beauty and her talent gained her universal admiration. David Garrick is said to have exclaimed, when informed of her death, "Then tragedy has expired with her." She is buried in Westminster Abbey.

CIBBER, Theophilus, English actor and dramatist, the son of Colley Cibber (q.v.): b. London, Nov. 26, 1703; d. at sea, October 1758. Educated at Winchester College, he was a friend of Richard Steele, in whose *Conscious Lover* he had his first part at the Drury Lane Theatre in 1721. Among his own plays are *The Lover* (1730); *Patie and Peggy; or, the Fair Foundling* (1730); and *The Auction* (1757). *An Account of the Lives of the Poets of Great Britain and Ireland* (1753), which appeared under his name, was largely from the pen of Robert Shiels, a Scotsman, who purchased for 10 guineas the right of prefixing to the work the name of Cibber, then in prison for debt. Cibber's second wife was Susannah Maria Cibber (q.v.), from whom he separated in 1738. When on his way to Dublin, his ship was lost and he was drowned off the coast of Scotland.

CIBOLA, sê-bô'lä, Seven Cities of, legendary towns reputed to possess great riches in gold and probably situated in what is today northern Mexico (Sonora) and the southwestern United States (southern Arizona). They were first reported by survivors of Pánfilo de Narváez' expedition to Florida (1528) and the name was used in 1539 by Fray Marcos de Niza (or da Nizza) for several Zuñi villages. Niza's somewhat fan-

tastic reports induced Francisco Vázquez Coronado to undertake his celebrated expedition in 1540. See also PUEBLO INDIANS; ZUÑI.

Consult Nizza, M. da, *Discovery of the Seven Cities of Cibola* (Santa Fe, N. Mex., 1926); Sauer, C. O., *Road to Cibola* (Berkeley, Calif., 1932)

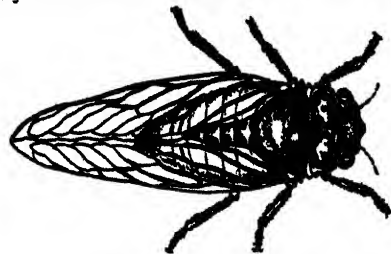
CIBORIUM, si-bō'ri-ūm, the sacred vessel of silver, gold, or silver gilt, usually goblet shaped and covered, in which the sacred host is reserved. Its liturgical name is pyx.

In architecture ciborium is the name of the canopy which overhangs the high altar of a church.

CIBOTIUM, si-bō'ti-ūm, a genus of tropical and semitropical ferns, some of which are cultivated in greenhouses. *C. schidei* is one of the most graceful of the *Cibotium* tree ferns and is favored in large greenhouses. Another species, *C. barometz*, is presumed to have been the inspiration for the legendary Scythian or Tatarian lamb or barometz, a woolly, hoofed, half-creature and half-plant which was said to grow on a stalk attached to the navel and which fed in a circle, pivoting on the stalk. It was thought to fade and die when it had consumed the herbage within reach. The legend is attributed to this fern because of its golden woolly thick rhizomes that retain the old stalk bases, which resemble somewhat the legs of a quadruped. The "wool" has been utilized as a padding or stuffing material and also as a styptic. A starch has been extracted from the trunks of some species of *Cibotium*.

CIBRARIO, chē-brä'ryō, CONTE Giovanni Antonio Luigi, Italian statesman and historian: b. Turin, Italy, Feb. 23, 1802; d. Trebiolo, Oct. 1, 1870. After completing his studies in canon law, he soon distinguished himself by his historical investigations, pertaining particularly to the history of the house of Savoy. In 1848, when Italy rose against the Austrians, Charles Albert, king of Sardinia, appointed him senator of Sardinia. The same year Cibrario helped to bring about a union of Venice with Lombardy and Piedmont. He was made minister of finance in 1852 and in 1855 minister of foreign affairs. Among his published works are *Dell' economia politica del Medioevo* (1839); and *Storia di Torino* (1847).

CICADA, si-kā'dä, the name given to any member of the family Cicadidae, of the insect order Homoptera, which is considered by some to be a suborder of Hemiptera. The suborder Homoptera differs from the Hemiptera in that the wings are of uniform texture and are held roof-like over the abdomen when the insects are at rest. As compared with other insects, the cicadas are all of medium to large size, about one to three inches. They are characterized by having wholly membranous wings, three ocelli situated



Seventeen-year cicada.

on the front between the compound eyes, a long rostrum or sucking beak, and five- or six-segmented small bristlelike antennae, arising from a short basal segment. The front femora are enlarged and usually bear spines, which are used in the nymphal stage for tunneling through the ground; and the males, with few exceptions, have a well-developed tympanum or sound-producing organ on each side of the abdomen near the base. The species of the temperate zones are, as a rule, rather somber in color, but many of those found in the tropics have the wings brilliantly colored.

The larva or nymph of the cicada bears much less resemblance to the adult than do any other members of the orders Hemiptera or Homoptera. The nymphal stage is spent on the ground, the insects sucking sap from the roots of herbaceous or woody plants. The majority are found in forest areas, though many have adapted themselves to prairie or savanna areas where they feed upon the roots of broad-leaved plants. The eggs are laid in the twigs of trees or the stems of shrubs and plants. The ovipositor of the female is long and strong and reposes within lateral sheaths: with this she saws a long slit in a place suitable for oviposition and deposits her eggs, to the number of three to 15. The number varies according to the suitability of the spot selected; each female lays a total of from 50 to 150 eggs. The life cycle of cicadas varies from two to five years, depending upon the species, but in two forms it requires 13 and 15 years respectively.

The male cicadas, except for two species of *Tettigarcta* in Australia, all "sing" by rapid vibration of the tympanum. Each species has a different song and many so far undescribed species have been recognized by the sounds they make. For the most part, cicadas sing only during the hot portion of the day and only when the temperature is above 60°F. However, a few species will continue to sing after the sun sets if the moonlight is bright; others normally sing at night. The female is attracted to the male by his song, but once she alights near him, he forgets music and pays strict attention to her.

One of the largest species is the great Borneo cicada, *Pomponia imperatoria*, a night singer with a wing expanse of eight inches, used as food in Malaya. Other kinds are eaten in various parts of the world. The Chinese blistering cicada or Chu-ki, *Hucchys sanguinea*, with rich red and black coloration, is often found on *Ailanthus* (trees). The dog-day cicada or lyreman, *Tibicen linnei*, is a large green and black American species with a shrill, noisy song during the harvest season. Only a single species of more than 1,500 known kinds, *Cicadetta montana*, is found in Great Britain. A dozen species occur on the European continent. North America has more than 200 species but the family has its greatest representation in the tropics.

The most famous of all the cicadas is the 17-year locust, *Magicalcica septendecim*, first noted by American colonists in 1633 during an outbreak which covered the northeastern portion of the present United States. The broods are numbered from one to 17 and the area and time of the appearance have been carefully plotted. The most widely distributed and most abundant brood is No. X, which occurs over the whole range of the insect. Its most recent outbreak in the United States was in 1953. It will be present again in 1970 and again in 1987. The second largest brood is No. XIV, which will appear in 1957 and each

succeeding 17 years in most of the area where brood X occurs. In the southern half of the eastern United States there is a race of *M. septendecim* that requires only 13 years to reach maturity. See also GRASSHOPPERS AND LOCUST PLAGUES; LOCUST.

CHARLES H. CURRAN.

CICATRIZATION, sĭk-ă-trĭ-ză'shŭn, the healing process of the skin brought about by the formation of scar tissue. Springing from both sides of the wound, this new connective tissue—the cicatrix—appears as red or purplish in color when newly formed, and white and glistening when older. Tissue repair may be stimulated by injury to tissue cells caused by accident or inflicted intentionally as in operations. The damaged cells liberate fibrin with the coagulated blood plasma which furnishes the framework for subsequent skin growth.

CICER, sĭ'sēr, a genus of the pea family related to the vetches, peas, and beans. The genus numbers 15 species native to western Asia, and includes the chick-pea or garbanzo, *C. arietinum*, which is cultivated for the edible seeds in southern Europe, Asia, and the American tropics. See also CHICK-PEA.

CICERO, sĭs'ēr-ŏ, Marcus Tullius, Roman jurist, orator, author, statesman, and perhaps the greatest master of Latin prose style: b. Arpinum (modern Arpino), Latium, Italy, Jan. 3, 106 B.C.; d. Formiae (modern Formia), Latium, Dec. 7, 43 B.C. His father was a knight of good social position and the son was well educated in preparation for the bar and for public life. While still a young man he served in a campaign under Gnaeus Pompeius Strabo. He first appeared as a lawyer in 81 B.C. and again in 80, and in the latter case was brought into direct collision with a favorite of the dictator Lucius Cornelius Sulla. It was perhaps in consequence of this that he withdrew for a time from Rome and spent the years 79-77 in Greece and Asia Minor, occupying himself with the further study of oratory.

In 75 Cicero began his political career by serving as quaestor in Sicily, and in 70 he gave evidence of the closeness of his relation to that province by prosecuting Gaius Verres for maladministration as governor there. In 69 he was curule aedile and in 66 urban praetor, following the usual course of offices. In the latter year he made his first distinctively political speech in support of a proposal by the tribune Gaius Manilius to give to Gnaeus Pompeius Magnus (Pompey) the command of the war against Mithridates VI, king of Pontus. Though the distinction between parties was then less sharp than it is now, he had thus far been connected with the democratic party, but in the canvass for the consulship for 63 that party had already two candidates in the field. Cataline and Gaius Antonius, while the Optimates had no candidate of special promise. As Cataline belonged to the radical wing of the democrats, the senatorial party, desiring his defeat, threw its influence in Cicero's favor. He was thus elected as a representative of the Optimates and continued to act with that party during the rest of his life. His constitutional instincts were further strengthened by the outbreak during his consulship (63) of the so-called conspiracy of Cataline, an attempt by the radicals under the leadership of this reckless

noble to seize the government by violent means. This attempt Cicero suppressed with considerable vigor; Catiline was killed in battle and several of his associates were condemned to death by a vote of the Senate and executed under Cicero's orders. The execution, however, was of questionable legality, since it set aside the right of the accused to an appeal to the popular assembly, and Cicero was at once attacked by members of the democratic party for his responsibility in the transaction.

Upon the formation, in 60, of the coalition between Pompey, Gaius Julius Caesar, and Marcus Licinius Crassus, called the First Triumvirate, by which the democrats came into control of the government, Cicero was banished from Rome and left Italy (April 58). The years preceding his exile had been years of great professional activity and some of the best of his speeches belong to this period, but he had not yet acquired the habit of literary production and the year of his absence was unfruitful except in letters. His return to Italy in 57 was made the occasion of a great party demonstration and was to some degree a personal triumph, and he engaged himself at once in suits for the recovery of his property and in the party struggles with the Triumvirate. During this period he also resumed his early studies in rhetoric and wrote the *De Oratore*, one of his most finished and authoritative works.

Hitherto Cicero had not followed the usual custom of taking the proconsular governorship of a province, but in 51, in compliance with a new law, though much against his will, he went as governor to Cilicia. He spent here exactly the year required of him, from July 31, 51 to July 30, 50; but, impatient as he was of the enforced absence from Rome, his governorship was highly creditable to him; he showed, in particular, the most honorable scrupulousness in abstaining from even the customary exactions from the provincials.

When he returned to Rome, Cicero found all parties absorbed in the agitations which preceded the civil war. Early in 49 Caesar marched upon Rome and Pompey withdrew to Dyrrachium (now Durres, Albania). During these months Cicero remained away from the city in great uncertainty as to his duty and his interests. Caesar asked of him only that he should remain neutral, and his own forebodings as to the outcome of the struggle inclined him toward this course, but his party connections, his constitutional prejudices and opinions, and his lifelong respect for Pompey took him finally to the camp at Dyrrachium. After the victory of Caesar at Pharsalus in August 48, he returned to Italy and spent a year in Brundisium (now Brindisi), awaiting Caesar's permission to go to Rome.

From the summer of 47 to March 44 the domination of Caesar put an end to free discussion and action in the state and Cicero made only a few speeches, addressed to Caesar, with whom he had always been on terms of friendship, on behalf of persons desiring amnesty. But the enforced political inactivity he put to use in literature, and to this period belong almost all his greatest writings, the ripe fruits of a life of intellectual interests. In March 44 the assassination of Caesar aroused in Cicero, though he was not cognizant of the plot, a renewed hope that the Senate might recover control of the state. But for the first few months events turned against his party; popular feeling did not approve the

death of Caesar, Marcus Antonius (Mark Antony) was unexpectedly active and successful, and Cicero for a time thought of joining Marcus Junius Brutus and Gaius Cassius Longinus, the tyrannicides, in the east. As the confusion began to clear, however, and the old issue between constitutional government and the rule of a dictator took form, Cicero's indecision came to an end and he threw himself unreservedly into the contest of the Senate with Antony. The 14 *Philippics*, delivered between September 44 and March 43, are unmatched among his speeches. When Antony and Gaius Julius Caesar Octavianus (the later Augustus) were reconciled and formed with Marcus Aemilius Lepidus the Second Triumvirate, Cicero's name was placed upon the list of the proscribed, and he was killed at his villa near Formiae.

The literary work of Cicero is in amount much greater than the extant work of any other Latin writer and in value is perhaps second only to the verse of Virgil. It consists of orations, rhetorical works, philosophical essays, and collections of letters, and will be discussed in that order.

Of the orations we possess 57 in nearly complete form and the titles of some 80 more are known. The extant orations are about equally divided between speeches to the Senate or the people on public questions and legal pleas. Cicero spoke by preference on the side of the defense in both civil and criminal trials, sometimes making a close legal argument, but not infrequently using also political and even literary discussions to relieve the formal argument. The public orations are to a considerable extent invectives, especially the 4 orations against Catiline and the 14 *Philippics* against Antony, and these are at times bitter to a degree that modern taste would condemn, even in the most excited political struggles. But the wit, the fire, the humor and breadth, the easy handling of complex argument, and the perfection of stylistic form are such that no critic, either ancient or modern, has seriously questioned Cicero's supremacy in Roman oratory.

The rhetorical works deal chiefly with oratory; several are textbooks on the theory and practice of public speaking, one is a history of Roman oratory, and one is a discussion of the ideal in oratory. While Cicero did not attempt a wholly novel treatment of these subjects, there is in the works much of the ripe judgment of the practiced speaker who was interested also in the theory of his life work, and they contain some of his most finished and delightful writing.

The philosophical works are constitutional and ethical essays in dialogue form. Cicero himself regarded them as useful means of making educated Romans better acquainted with Greek philosophy, especially of the Academic and Stoic schools, and made for them no claim to originality of thought.

The uncertainty of the judgment of posterity was never better illustrated than in the history of opinion in regard to Cicero. During the earlier centuries after the Revival of Learning, the judgment which scholars formed in regard to Cicero's public career was really determined by their just admiration for his Latin style. But with the rise of historical science a revision of opinion was inevitable. This found expression in Wilhelm Drumann's *History of Rome* . . . and later in Theodor Mommsen's history; in both these writers the extravagant and passionate dis-

crediting of Cicero was as marked as the earlier unquestioning worship had been. However, half the discussion in regard to the character of Cicero is fundamentally an expression of opinion or feeling about the constitutional crises and political issues of his time. The severest critics of Cicero have been German scholars, eminent indeed, but accustomed to feudal traditions and inexperienced in the workings of a free constitution. The judgment of English scholars, though not unanimous, has been more liberal.

Cicero was, as most orators are, a man in whose temperament emotion and sensibility were more controlling than intellect or will. Such a man is always liable to the charge of inconsistency and his conduct is certain to show extremes of weakness and of strength. On three occasions, in the trial of Sextus Roscius Amerinus, in the affair with Catiline, and in the struggle with Antony, he showed the hot courage of attack, but in the trial of Titus Annius Papianus Milo he failed to exhibit the cool and steady courage required to face mob violence. At the outbreak of the civil war he hesitated long—not wholly without reason—and after the death of Caesar his vacillation amounted to weakness, but taken as a whole his public life was a consistent expression of his patriotic feeling.

EDWARD PARMELEE MORRIS.

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CICERO'S LETTERS

The letters, *Epistulae*, of Cicero cover a period of 25 years, from 68 to 43 B.C., the year of the orator's death, and are embraced in four groups:

(1) *Epistulae ad Familiares*, consisting of 16 books of letters to various friends, including an entire book of those addressed to his wife and children, and another book of those to his faithful freedman Marcus Tullius Tiro.

(2) *Epistulae ad Atticum*, likewise consisting of 16 books, a witness to the lifelong friendship and intimate relations subsisting between Cicero and Titus Pomponius Atticus.

(3) *Epistulae ad Quintum Fratrem*, three books of letters to Cicero's brother Quintus Tullius.

(4) *Epistulae ad Marcum Brutum*, two books of letters to the Brutus who headed the conspiracy against Julius Caesar.

The contents of the letters are so various that it is difficult in brief compass to give any adequate conception of their range and quality. Many of them deal directly with the stirring political issues of Cicero's own time, the strife of parties, the competition for office, the ambitious aspirations of Caesar, Pompey, and Crassus in the First Triumvirate, the struggle between Caesar and Pompey and the chaotic conditions subsequent to Caesar's assassination. Others have to do with the purely personal affairs of the writer, the publication of his works, the construc-

tion and furnishing of his villas, or the gossip of the day. Several touch upon the domestic infelicities of Quintus Tullius Cicero and his wife, Pomponia, the sister of Atticus, in which Atticus naturally blamed Quintus, while Cicero blamed Pomponia.

Most of the letters are written in the more intimate style of the Roman *sermo familiaris*, contrasting strongly with the studied elegance of the formal style characteristic of Cicero's other works. Equally marked is the unreserved frankness with which Cicero discusses the men and measures of his day. In the letters to Atticus, in particular, he practices as little reserve as if he were writing a diary for his own private edification. As a result, some of the less attractive features of Cicero's personality are brought out in strong relief. In 65 B.C. we find him writing to Atticus that he contemplates the defense of the unsavory Catiline. "I am thinking," he says, "of defending Catiline. We can have any jury we wish with the full consent of the prosecutor. If Catiline is acquitted, I hope it will make us better friends." Thus he writes of the man whose true character he knew well, and whom only two years later he was branding in his speeches with all the vituperation at his command.

The four collections above enumerated contain about 925 letters written by Cicero. As many more are believed on good grounds to have existed in antiquity and to have been lost. Incorporated in the *Epistulae ad Familiares* and the *Epistulae ad Atticum* are some 125 letters written by Cicero's correspondents. Thus we have an entire book of letters from Marcus Caelius Rufus. Others from whom letters are preserved are Lucius Munatius Plancus, Cato the Younger, Pompey the Great, Gaius Cassius Longinus, Marcus Aemilius Lepidus, and Gaius Asinius Pollio. One of the most notable letters is from Caesar, written in reply to one of Cicero. Cicero had praised the dictator for his magnanimity in sparing the lives of his opponents who had surrendered at Corfinium. Caesar's reply breathes the same generous spirit which had prompted his act of clemency.

In their range, their sincerity, their connection with the events of the time, and their intensely human quality, the *Letters* are not only of commanding interest, but they are of the greatest value in helping us to understand the complex character of the orator and the tangled events of his day. In modern times the first manuscript of the *Letters* was discovered by Petrarch in the 14th century. The great humanist was shocked at the new light thrown by them on Cicero's character and composed his famous letter to Cicero.

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CHARLES E. BENNETT,
Revised in the "Encyclopaedia Americana" Editorial Office.

CICERO, Marcus Tullius, Roman administrator and politician, only son of Marcus Tullius Cicero (q.v.), the orator, and of Terentia: b. Rome, Italy, 65 B.C.; d. after 28 B.C. After accompanying his father to Cilicia (51 B.C.), he served during the civil war with Gnaeus Pompeius Magnus (Pompey the Great) in Greece,

where, despite his young age, he probably had a command at the Battle of Pharsalus (48 B.C.). Sent to Athens to study, he inclined toward dissipation and indolence. Upon Gaius Julius Caesar's murder (44 B.C.) he sided with Marcus Junius Brutus, but joined Sextus Pompeius after the Battle of Philippi (42 B.C.). Returning to Rome, he was pardoned by Gaius Octavianus (Augustus), who shared the consulship with him in 30 B.C. Later he served as proconsul in Asia during 29–28 B.C.

CICERO, Quintus Tullius, Roman general and younger brother of Marcus Tullius Cicero (q.v.), the orator: b. Arpinum (Arpino), Italy, about 102 B.C.; d. December 43 B.C. Educated with his brother, he had little taste for oratory, though he seems to have shown some literary ability; but there is virtually nothing left of his works. His marriage to Pomponia, the sister of Atticus, which was arranged by Marcus, was unhappy. After serving as aedile (65 B.C.) and as praetor (62 B.C.), he left mainly a mark as a military leader. He saw combat in Gaul and in Cilicia. In the civil war he initially supported Pompey, but later joined Gaius Julius Caesar. Like his brother, he was proscribed by the Second Triumvirate and was slain with his son Quintus Tullius.

CICERO, Quintus Tullius, son of Quintus Tullius Cicero (q.v.): b. 67 B.C.; d. December 43 B.C. His uncle Marcus Tullius Cicero supervised his education and took him to Cilicia (51 B.C.). After Gaius Julius Caesar's assassination (44 B.C.), he sided with Marcus Antonius (Anthony), but later turned to Marcus Junius Brutus. He, too, was proscribed by the Second Triumvirate and executed with his father.

CICERO, sis'ēr-ō, town, Illinois, in Cook County; altitude 610 feet; contiguous in the north and east to Chicago, of which it is the largest suburb, though an economic center in its own right. It is served by the Baltimore and Ohio, and the Chicago, Burlington and Quincy railroads. Cicero, site of the main plant of the General Electric Company, is an important manufacturing center, producing telephone, radio, and electrical equipment, castings and forgings, pumps, printing machinery, engravers' supplies, rubber products, and home appliances.

The town originally consisted of a few families living in the swampland, probably as early as 1833; it was incorporated in 1867 and received a charter in 1869. As Chicago prospered and gradually absorbed parts of Cicero, industry brought new population to balance the losses. Former sections of the town, Berwyn and Oak Park (qq.v.), were set up as separate communities in 1901. During prohibition in the 1920's, Cicero became the domain of Al Capone, who organized here his brewing and gambling enterprises until indicted in 1931. Cicero is the seat of Morton Junior College and is governed by a mayor and council. Pop. (1950) 67,544.

CICERONE, chē-chē-rō'nā, an Italian name for a guide who conducts visitors or tourists to places of interest, particularly antiquities. The eloquence of the cicerone was likened to Cicero, the Roman orator. Later, cicerone also came to designate historic travel books, among the most notable of these being the *Cicerone* by

Jakob Burckhardt, describing the art treasures of Italy.

CICHLID, sīk'lid, any of about 600 species of freshwater fishes of the family Cichlidae, order Chromides. They are found from Texas to northern South America, in a few islands of the West Indies, throughout Africa, where the greatest number of species occur, and two species are found in southern India and Ceylon. Some species have a tolerance for brackish and even salt water for varying periods of time. The order is distinguished by possession of one nostril on each side, as compared with two for other spiny-rayed fishes.

Cichlids are usually less than one foot long, but a few species reach two feet. About 100 species are used as aquarium fishes and several species have become semidomesticated. The members of this family practice highly specialized parental care, in which usually both parents take part. See also **TILAPIA**.

C. W. COATES.

CICISBEO, chē-chēz-bā'ō, or **CAVALIERE SERVENTE**, a name given since the 17th century in Italy to the professed gallant of a married lady. It was the fashion among the higher ranks in Italy for the husband, from the day of marriage, to associate with his wife in his own house only. In society or places of public amusement she was accompanied by the cicisbeo, who even attended at her toilet, to receive her commands for the day. The custom gradually disappeared in the 19th century.

CICOGNARA, chē-kō-nyā'rā, **CONTE Leopoldo**, Italian antiquarian, diplomat, and art historian: b. Ferrara, Italy, Nov. 17, 1767; d. Venice, March 5, 1834. He studied at Modena and Rome, and was later appointed ambassador to Turin and counselor of state. In 1808 he became president of the Academy of Fine Arts in Venice. His most important work is the *Storia della scultura dal suo risorgimento in Italia fino al secolo di Canova* . . . , 3 vols. (1813–1818). Cicognara also wrote an autobiography, published posthumously in 1888.

CICONIIFORMES, sī-kō-nī-i-fōr'mēz, or **HERODIONES**, an order of wading birds containing the following families: Ciconiidae, or storks; Threskiornithidae, or ibises and spoonbills; Scopidae, or hammerhead storks; and Ardeidae, or herons and egrets. All of these birds are long-legged wading forms. The flamingos, family Phoenicopteridae, are also placed in this order by some authorities. See also **STORKS**.

CICUTA, sī-kū'tā, a genus of poisonous plants commonly known as water hemlock and related to *Conium maculatum*, or poison hemlock. Both genera belong to the parsley family (Umbelliferae). The eight species of *Cicuta* occur in marshy places or along streams throughout the northern temperate zone. They are perennial herbs with white tuberous fleshy roots, pinnately compound leaves, and small white flowers borne in compound umbels. The important North American species are *Cicuta maculata* (variously known as musquashroot, beaver poison, spotted cowbane) which ranges from Quebec and Manitoba to Maryland and Texas; *C. bulbifera* in the eastern United States and Canada north to New-

foundland; and *C. vagans* and *C. douglasii* in the western United States. The plants are deadly poison. This fact is implied by the very name *Cicuta*, the Latin name for the hemlock which the Greeks may have given to criminals as a death potion; though the symptoms of poisoning in Plato's description of Socrates' death (in *Phaedo*) seem to point to *Conium maculatum* (poison hemlock). Cattle have reportedly died from browsing on the herbage and persons are known to have been poisoned from eating the roots. The poisonous principle, a resin-like substance (*cicutoxin*) soluble in alcohol, is dispersed through the whole plant but is most concentrated in the roots. Treatment of patients poisoned by this agent involves evacuation and stimulation of the stomach. See also HEMLOCK, POISON.

VERNE GRANT.

CID, The, *síd* (Span. *EL CID CAMPEADOR*, the Lord Champion; Arab. *SAYID*; real name RODRIGO (or RUY) DÍAZ DE RIVAR), Spanish soldier and national hero: b. Bivar or Vivar, near Burgos, Spain, about 1040; d. Valencia, 1099. Legend and tradition have somewhat obscured the character of the historical Cid, but the main facts of his life are well established by Spanish and Arabic records. He first appears in national history when Sancho II, eldest son of Ferdinand I and king of Castile, was at war with his brother, Alfonso VI of León. In this war the Cid commanded the victorious forces of Sancho. Alfonso was taken prisoner, and it remained only to overcome the obstinate resistance of Zamora, where Sancho's sister, Urraca, ruled. Before the walls of this city Sancho was assassinated, and Alfonso VI (Alfonso el Bravo) was called to the throne of Castile.

It is asserted that before recognizing Alfonso's authority the Castilian nobles required of him an oath that he had had no part in his brother's murder, and that it was the Cid who administered this oath, in 1073. Alfonso gave his cousin Ximena (Jimena), daughter of the count of Oviedo, to the Cid in marriage. The marriage contract, dated 1074, is preserved at Burgos. Later the king, taking advantage of a pretext that the Cid had attacked the Moors without obtaining the royal consent, banished him (1081). Thence began that career of "soldier of fortune," which, idealized by tradition, has made the Cid the perfect cavalier of Spain.

He first offered his services to the Christian count of Barcelona, and when refused by him, to the Moorish king of Saragossa, who accepted the offer. The Cid remained in Saragossa until 1088, fighting against Moors and Christians alike, and rising to unusual distinction and power. In 1088 the attention of Mostain, the king of Saragossa, was drawn to the city of Valencia, then under the protection of Alfonso. The Almoravides, a new Moslem sect from northern Africa, defeated Alfonso in battle, and caused him to withdraw his protection from Valencia, and the governor of the city appealed to Saragossa for help. The Cid was sent to the aid of Valencia which he eventually secured for himself in 1094. He successfully held the city until 1099, when the troops he had sent against the Almoravides were utterly routed, few escaping. The Cid, already enfeebled in health, died, it is said, of grief and shame. His widow held Valencia for two years longer. He left two daughters, one of whom married the count of Barcelona, and

the other the infante of Navarre. The Cid is now buried at the cathedral of Burgos.

In somewhat romanticized versions, the Cid and his exploits became favorite literary themes. He stood as the prototype of the noble, generous Castilian, of the doughty champion of Christendom, and as such he appeared in innumerable popular songs and ballads and in the first and greatest epic poem of Spanish literature, the *Poema del Cid*, or *Cantar de Mio Cid*. The poem reflects in a deeply emotional and human way the daily life, customs, and ideas of the times. Written about 1140, the poem was preserved in a copy made in 1307 by Per Abbat. The modern Spanish scholar Ramón Menéndez Pidal has elucidated most exhaustively the poem and its background.

Another poem of about the same time, *El Rodrigo, o las Mocedades del Cid*, is of inferior merit, though not without fine passages. Two centuries and more after these poems we meet with the *Romances* or *Ballads of the Cid*. These ballads depict Ximena Gómez as the wife of the Cid and tell the legendary story of her father, Don Gómez, insulting the Cid's father; of the ensuing revenge of the Cid by killing Don Gómez; of Ximena's pursuit of the Cid demanding justice of King Ferdinand; and the final reconciliation through marriage. (See also ROMANCERO DEL CID.)

Guillén de Castro y Bellvis, in his drama *Las mocedades del Cid* (*The Youth of the Cid*, c.1612-1613), drew his material from the ballads, but added love and the conflict between affection and the claims of honor in the mind of both Ximena and the Cid. Pierre Corneille based his famous drama *The Cid* (see *Cid, The*) upon that of Castro, using the same plot and the same struggle between love and duty. Corneille's play inspired the opera of the same name by Jules Massenet. There are several English translations of these ballads.

Bibliography.—Southey, Robert, *Chronicle of the Cid* (London 1808); Huber, V. A., *Geschichte des Cid* (Bremen 1829); Menéndez Pidal, R., *Cantar de mio Cid: texto, gramática y vocabulario*, 3 vols. (Madrid 1908-11); ib., *The Spain of the Cid* (London 1947).

CID, The (*LE CID*), the play through which Pierre Corneille first (1636) gained distinction as a dramatist, marks a turning point in the development of the French state. The scene is Seville, at the court of Ferdinand, king of Castile; the time about 1075; the theme, a struggle between love and honor. The kernel of the story, telling the early deeds of the Spanish national hero the Cid (see *CID, THE*), belongs to historic tradition and was borrowed by Corneille from the chronicles of Juan de Mariana, the Spanish ballads, and the drama of the Spaniard Guillén de Castro y Bellvis. Condensing de Castro's play, Corneille gave it dramatic unity and added greater dignity and nobility to the verse.

The play was popular from the first, even though the Academicians professed alarm; Cardinal Richelieu was jealous, for he had literary foibles, and Corneille found it prudent to withdraw for three years from Paris to Rouen. Nicolas Boileau, however, testified that "all Paris has for Rodrigue (the Cid) the eyes of Chinène," and, while this romantic drama lacks ethical depth and tragic force, it is still the most acted of Corneille's plays.

Bibliography.—*Le Cid* is best edited with English notes by C. Searles (Boston 1912). Concerning contro-

versies over the play consult: Gasté, A., *La Querelle du Cid* (Paris 1878) and Searles, C., *Les Sentiments de l'Académie Française sur Le Cid* (Minneapolis 1916).

CIDER, sī'dēr, a beverage made from the juice of apples. In Europe the term generally means a beverage made from fermented apple juice. But in the United States, unless specifically qualified as "hard" cider, it is made of unfermented apple juice. "Sweet" cider is the traditional New England and American drink, normally reaching its height in consumption during the autumn months. In France, in Normandy and Brittany, a fermented and aged cider is the native "wine" of those districts. In England, cider rivals beer in popularity in the counties of the southern and western sections of the country. Cider is also a popular beverage in Germany, Spain, and Switzerland.

In the United States and Canada, homemade cider is usually not processed, and has a sweet flavor, differing only slightly in taste from pure apple juice. It tends, however, to be a little heartier to the taste. But if put in a warm place, unrefrigerated, or neglected for too long a time, it crosses the line of fermentation and becomes sharp and vinegary to the taste. A patent was issued as early as 1862 in the United States, on canned and concentrated apple cider, but techniques have made great changes since then. The modern commercial product known as cider has a uniform flavor, though the characteristic taste of different brands may vary according to the types of apples used. The maturation and weather conditions of the year of manufacture may also be reflected in the taste. Commercial cider is pasteurized in order that its preservatives—sugar, malic acid, and tannin—are evenly distributed and uniform flavor is maintained. The formulas commercially used are carefully guarded secrets of the competing firms. Generally, of course, similar processes are followed: selected apples (the whole fruit) are grated in a mill, juice is extracted by means of a press, preservatives are added, and bottling completes the process.

Processing plants go into top speed early in September, as the apples ripen. Thousands of women seasonal workers join the permanent plant employees in handling the apple harvest. Trucks bring the apples into the plant yards. Next, the fruit is floated down watery troughs to be spray-washed before it is moved onto conveyor belts for preliminary inspection. The characteristics of a good cider apple are a red skin, tough and fibrous pulp, astringency, a certain dryness, and the specific gravity of its unfermented juice, or its weight as compared with that of an equal amount of water. This latter comparison is a fairly accurate indication of the strength of the future cider. Apple weight, and consequent value for this purpose, increase according to the ratio of the increase of saccharine matter. The United States Department of Agriculture has stated that much of the most highly favored apple cider has been produced from fruit growing on a shallow loam upon a limestone base. It would seem desirable that calcareous earth should be a part of the soil of a cider orchard, preferably dry and somewhat loose in structure. Cider apples should be plucked at the height of their maturity, before decay sets in. The fruit should remain on the tree until late, just short of actual frost. When harvested, some processors prefer to store the fruit in a cool, shaded room to attain further ripening during

which the apples acquire more saccharine matter while losing a considerable percentage of watery juice. The grinding operation proceeds best under conditions of cold which retard rapid fermentation. The whole fruit is reduced to a mass, then exposed to air for a short time to absorb oxygen. The mass is subjected to power pressure again, and the cider runs off into casks. In the year 1939, the United States Department of Commerce figures showed a production of 12,618,000 gallons of undifferentiated cider and vinegar stock, worth \$1,617,000. By 1947, when cider manufacture was separately listed, production totaled 11,629,000 gallons of cider, valued at \$3,262,000. No figures have been released since that date.

The degree of fermentation of apple juices in commercial processing is now highly controlled and can be initiated or halted at desired times. Through these controls and further distillation processes other cider products are obtained. A strongly fermented cider produced by distillation is called cider brandy or applejack, historically a "hard" beverage of pioneer days. This contains a large percentage of alcohol. Another variation of the manufacturing process turns cider into a species of vinegar. See also VINEGAR.

CIEGO DE AVILA, syā'gō thā ä'vê-lā, city, Cuba, located in Camagüey Province, on the Central Highway and the main line railroad, about 65 miles west-northwest of Camagüey and 15 miles from its Caribbean port, Júcaro. A transport and trading center for a fertile region producing sugarcane, tropical fruit, and cattle, it has various processing industries. In the war of independence (1895-1898) Cuban patriots pierced the Spanish defense line outside Ciego de Ávila. Pop. (1943) 23,802.

CIENAGA, syā'nā-gā, city and Caribbean port, Colombia, in Magdalena Department and on the Ciénaga (swamp) Grande, about 35 miles east of Barranquilla. It is linked by rail with Santa Marta, 17 miles south. Serving a productive agricultural region that yields mainly cacao, bananas, cotton, and tobacco, it also has important fisheries. Pop. (1938) 22,783.

CIENFUEGOS, thyān-fwā'gōs, **Nicasio Alvarez de**, Spanish poet and playwright: b. Madrid, Spain, Dec. 14, 1764; d. Orthez, Basses-Pyrénées, France, June 30, 1809. While studying at the University of Salamanca (1782-1787), he counted among his friends José Cadalso and Juan Meléndez Valdes, leading 18th-century poets. With them he founded the Salamancan school of poetry. The presentation of his tragedies *Zoraida* and *La Condesa de Castilla* won him recognition as a dramatist, and after the publication of his poems in 1798, he was appointed editor of the government publications *La Gaceta* and *El Mercurio* and, later, first secretary in the Department of Foreign Affairs. Though an admirer of French culture and of Napoleon, he sided in May 1808 with the Spanish patriots against the French invaders, and was brought to trial and condemned to death. However, the sentence was commuted to banishment to France. In addition to the plays mentioned above, he wrote *Idomeneo*, *Pitaco*, and *Las hermanas generosas*, and numerous poems, anticipatory of the Spanish romantic movement. His collected poems, *Obras poéticas*, were published in 1816 by order of the king.

CIENFUEGOS, syân-fivâ'gô's, Cuba, municipality and town in the province of Las Villas, on the south side of the island. Its harbor, which is one of the finest in the West Indies, was visited by Columbus on his first voyage, and was surveyed by Florián de Ocampo in 1508. The town was settled by refugees from Santo Domingo in 1819. Here the revolutionist Narciso Lopez planned to make his first demonstration on July 4, 1847. (See also CUBA.) In recent years its commercial progress has been rapid, and it is now the second seaport of Cuba. Some of the sugar estates in the neighborhood are very large, and conducted on the most approved modern plan; in fact, Cienfuegos is the center of the sugar trade on the Caribbean coast. It is a city of attractive, well-shaded streets, and substantially built houses. One of its plazas is the largest in Cuba. Among the principal buildings are the governor's house, market, railroad station and military and government hospitals. Water from the aqueduct is supplied to 42 per cent of the dwellings; from wells, to 47 per cent; from cisterns, to 7 per cent. There are social clubs, and a theater. The city is lighted by gas and electricity. The climate from May to November cannot be highly commended, the air having an excess of moisture, and the temperature ranging from 75° to 98°F. The winter months, however, are very agreeable. Prevailing winds are from the north and the temperature ranges from 60° to 78°F. during the day, with cooler nights. Cienfuegos is connected by rail with Sagua la Grande, on the opposite coast; with Santa Clara, the western terminus of the Cuba Company's main line to Santiago; with Havana, etc. By steamer it is in regular communication with New York, as well as with ports of the southern coast of Cuba from Santiago to Batabano. Pop. (1943 est.) municipality 94,810; town 52,910.

CIEZA, thyä'thâ, Spain, commune in the province of Murcia, and 26 miles northwest of the city of Murcia, on an eminence near the right bank of the Segura. It has spacious streets, a large church and ancient tower, manufactures of linen and hempen fabrics, and a trade in corn, wine, oil and silk. Pop. (1941 est.) 23,499.

CIGAR. A cigar is a roll of tobacco suitably formed for smoking. It is composed of a "bunch" of filler leaves, held together by a binder leaf, around which a wrapper leaf is rolled in a spiral manner and carefully finished. The mouth or head end is sealed with the wrapper, which is especially cut to form the closed end. The wrapper leaf is of fine silky texture, of selected colors, with a desirable taste and good burning qualities. The filler may be a long filler extending the full length of the cigar, or it may be composed of short pieces formed into a bunch by a suitable roller.

A number of varieties of tobacco make up the "cigar types" (see TOBACCO). They possess characteristic properties of taste, aroma, burning qualities, leaf texture and other factors that are inherent in the genetic structure of the plant. The properties are modified by the soil and climate in which the plant is grown, methods of curing, and most important by a unique process of fermentation that distinguishes cigar tobaccos from those other varieties generally used for cigarettes and pipe smoking.

History.—Cigar smoking was observed on the island of Cuba by the first expedition of Christopher Columbus, in November 1492. It was popularized by sailors and explorers returning from expeditions to the Caribbean islands and South America. The Spanish in 1698 established a monopoly in Cuba. They also introduced tobacco culture and cigar manufacturing in the Philippine Islands, and for many years they dominated the cigar trade of the world. Cigar tobacco production became important in Mexico and several of the Spanish and Portuguese colonies in South America. It was later introduced into Germany, Switzerland, and the Low countries.

A cigar factory was established in Hamburg, Germany, in 1788, and cigars came into general use in Germany by 1793. The first factory in the United States was established at Suffield, Connecticut, in 1812. The Peninsular War introduced the cigar to the French and English soldiers. After peace was declared in 1815 cigars were allowed entry into England from Spain. They became, however, a luxury item on account of high import duties. The influx of immigrants into the United States during the middle 19th century brought a number of cigar makers from Germany, who set up small factories throughout the northern states, and gave impetus to the industry in the United States. This group of skilled Europeans modified the type of cigar from the Spanish or Cuban by blending with the large "seed-leaf" types grown in the Connecticut Valley. Between 1840 and 1875 cigar leaf production was established in Florida, New York, Ohio, Wisconsin, and Pennsylvania, thereby making available tobaccos of various qualities, and thus developing a cigar consisting of a blend of domestic tobaccos.

The principal types of tobacco now used in the United States for making cigars are the following: wrapper leaf of fine texture and color, with good taste, is produced under cloth shade in the Connecticut Valley, Florida, Georgia and Cuba. A wrapper leaf of excellent quality is produced in Sumatra. Binder leaves are grown in the Connecticut Valley, Wisconsin and Pennsylvania. The principal fillers are produced in Pennsylvania, Ohio, New York, Cuba, and Puerto Rico. One-sucker and tip grades of Maryland (both usually classified as types of chewing and smoking tobaccos) are sometimes used as part of a short-filler blend in the cheaper cigars.

Classification.—Cigars are classified by the trade according to the blend of leaf as: (1) clear Havana, (2) seed and Havana, and (3) seed. Because of the wide range of possible blends of tobacco of the various types no hard or fast rule can be made for the two latter classes. A clear Havana cigar is one made entirely of tobacco grown in Cuba, and is the world's standard of excellence. Seed-and-Havana refers to cigars in which the filler is of Cuban tobacco, with a domestic binder leaf, like Wisconsin, and the wrapper of domestic shade-grown or Sumatra leaf. Puerto Rican tobacco may be used as part of the filler along with the Cuban. A Seed cigar is one in which the filler may be of Ohio, Pennsylvania or New York tobaccos, with a Wisconsin or Connecticut binder, and a Sumatra or shade-grown wrapper. This type of blend is used in a large portion of the cigars made in the United States. Modifications may include a con-

siderable portion of Puerto Rican tobacco in the filler.

A stogie is a pencil-shaped cigar, made without a binder leaf. It usually uses Ohio or Pennsylvania filler, and a Connecticut wrapper. It derived its name from the Conestoga peddler wagons traveling the Cumberland Turnpike through Pennsylvania, Maryland, West Virginia and Ohio. "Conestoga cigars" were an important commodity between 1850 and 1910.

The Italian cheroot is made from heavily fermented fire-cured tobacco grown in Kentucky, Tennessee, and Virginia. The long filler leaves are rolled in a wrapper well impregnated with rice flour paste which securely seals the wrapper. After rolling the cheroots are trimmed off squarely at each end which is left open. They are slowly dried to a low moisture content. They are slightly larger than a pencil, and are cut in half before smoking. They are strong, aromatic and flavorful, and popular among smokers of Italian descent.

A cigarillo is a small cigar, of pencil thickness and four to five inches long, and usually is well and carefully formed.

A "little cigar" is about the size of the average cigarette, with a tobacco wrapper and a shredded filler of cigar tobacco.

Manufacture.—The manufacture of cigars in the United States has become highly mechanized since the introduction in 1917 of the first successful machine capable of making a complete cigar. Production has become concentrated into large manufacturing units. The skilled hand roller, who for hundreds of years prided himself upon his craftsmanship, has been relegated to the scattered small shops, and to a number of the old-line quality shops in Tampa, Florida, which have held out against mechanization. In Havana, Cuba, trade unions with government cooperation held out for many years against the cigar machine. Only since 1949 have they permitted their use. In 1917 there were 14,576 cigar factories in the United States none of which was mechanized in the modern sense, and all employing hand rollers. In 1948 the United States Internal Revenue Bureau reported 2,402 manufacturing units; 2,040 employing hand rollers produced 1.61 per cent, whereas 112 machine equipped units produced 92 per cent of the cigars manufactured.

Mechanization came slowly to the cigar industry. Many years of experimentation were required to produce a machine that now quite satisfactorily performs all of the operations of the deft hand roller. The standard long-filler machine requires three operators and an inspector. The first operator places the long filler leaves into a trough with a continuous feeding mechanism. The leaf is cut to proper length and fed against another knife which cuts out the quantity to form the bunch of proper amount and density. A second operator lays a binder leaf on a die plate equipped with small holes and suction to hold the leaf in place. A roller cuts the leaf to shape. An ingenious transfer arrangement transfers the cut binder to an apron where it is rolled around the charge of filler to form the bunch. This is then placed in a viselike tool the jaws of which are formed to the shape of the cigar, and the bunch is pressed to proper shape. A third operator places the wrapper leaf on a suction die plate, where it is cut to shape, and transferred to a position where it can be spiralled around the bunch, the head end pasted,

and the finished cigar is rolled to smooth irregularities in wrapping, and delivered to an inspector. Three operators can produce about 800 long filler cigars per hour. A machine designed for short filler cigars and only employing two operators to lay the binder and wrapper leaves can produce 13 cigars per minute.

From the machine the cigars are packed in bundles, usually of 50 cigars, and stored in a conditioning room for several days to equalize the moisture to about 16 per cent. They are temporarily packed in boxes to shape them, and then delivered to the cellophane wrapping machine where each cigar is jacketed and sealed, and packed for sale.

Consumption and Distribution.—The annual per capita consumption of cigars in the United States is about 39 cigars. The total United States production in 1949 reported by the Bureau of Internal Revenue was 5,769,868,000 "large" cigars, weighing more than three pounds per thousand. Cigars are taxed under the Internal Revenue Act of 1942 on the basis of their retail sale price, as follows: Class A (to retail at 2½ cents or less) at \$2.50 per thousand; B (2½ to 4 cents) at \$3.00; C (4 to 6 cents) at \$4.00; D (6 to 8 cents) at \$7.00; E (8 to 15 cents) at \$10.00; F (15 to 20 cents) at \$15.00; G (more than 20 cents) at \$20.00.

In 1949 the distribution of the 7 classes was as follows: Class A, 11,737,000 cigars; B, 298,841,000; C, 1,556,818,000; D, 581,231,000; E, 3,020,907,000; F, 160,458,000; G, 139,876,000.

"Small" cigars (weighing less than three pounds per thousand) are taxed at the rate of 75 cents per thousand; 90 millions of small cigars were produced in 1949.

Cigar factories are located in 45 states. Pennsylvania leads in production with 43 per cent of the domestic output, and 363 factories distributed over the state. Florida ranks second with 18 per cent of the output, and large manufacturing units at Jacksonville, Tampa and Quincy. New Jersey is third. Other important states include Ohio, Virginia, South Carolina, New York, Georgia, Kentucky, Indiana, Louisiana, Massachusetts, New Hampshire, West Virginia and Tennessee.

In 1949 the United States imported from Cuba 11,134,000 cigars, and produced in bonded factories, from Cuban tobacco 141,500,000. About six million cigars were imported from Puerto Rico. Thirty-one million cigars were exported.

Cigar production elsewhere in the world has kept pace with the progress achieved in the United States. Many of the mechanical improvements which led to present-day developments originated in European shops. Leaf from Cuba, Santo Domingo, Mexico, Brazil, Paraguay, Java, Sumatra, Borneo, Jamaica, Philippine Islands, India, as well as the tobaccos grown in western Europe, constitute a supply of raw material of a wide range of quality, and sustain a cosmopolitan cigar industry.

E. G. BEINHART.

CIGARETTES. A cigarette is a roll of tobacco wrapped in paper or corn husk. It may be hand rolled or machine made. One end may be supplied with a paper tube to serve as a mouthpiece, or tipped with a thin strip of cork, glazed paper, silk or other material to prevent the cigarette from adhering to the moist lips of the smoker. Loosely folded paper or cotton is

sometimes placed in the tubes to filter the smoke and collect the condensates of the volatile materials. The most popular cigarette, however, is plain, without mouthpiece or tip. Machine made cigarettes are of various diameters and lengths, with a circumference of from 22 millimeters to 32 millimeters, and a length of from 55 millimeters (2.16 inches) to 100 millimeters (3.93 inches). The popular brands average 1.05 grams tobacco, or 2.31 pounds per thousand cigarettes. In the United States the federal excise tax rate established by the Revenue Act of 1942, is \$3.50 per thousand cigarettes weighing less than three pounds per thousand. The rate is \$8.50 per thousand cigarettes when they weigh more than three pounds per thousand. This tax rate effectively limits the production almost entirely to the "small" cigarette. Proposals have been made to change the tax rate on small cigarettes from a uniform single rate to a differential rate, similar to the differential rate applied to cigars, based upon the retail sale price.

History.—The early Spanish explorers found the natives in the West Indies and Mexico smoking cigarettes, the former using thin palm bark, and the latter corn (maize) husks to wrap the tobacco. The history of the early development of the cigarette in Europe is not clear. It apparently followed the pipe, snuff, the cigar, and chewing tobacco in popularity. It appears that the Spaniards substituted paper for the corn husk wrapper. Cigarette smoking spread throughout the Mediterranean and Black Sea countries, especially in those areas under Turkish influence during the early 19th century. Land in the Balkans and around the Black Sea is well adapted for the production of fine aromatic tobaccos.

The Crimean War (1854-1856) introduced the cigarette to the English Army fighting in the Crimea. After that war the returned soldiers created a market for Turkish cigarettes, and a few years later the first cigarette factory was opened in London. About the same time a substantial cigarette manufacturing business was developed in Egypt, using Turkish-grown tobacco, and the "Egyptian" cigarette became the standard of excellence in the world's markets.

Production in the United States began in 1867 with the arrival of men skilled in the art of blending Turkish tobaccos. The first operators made little progress, as they lacked experience in blending the domestic tobaccos, and the American smokers were reluctant to accept the highly aromatic leaf from the Balkans. A small industry was established, however, during the 1870's employing hand rollers, capable of producing 1,500 to 2,500 cigarettes per day. The tobacco users of that period chewed about twice as much tobacco as they smoked in cigars, three times as much as they smoked in pipes, and the cigarette lacked acceptance in good society.

In 1883 a patent was issued to James Bonsack, of Virginia, for what proved to be the first serviceable cigarette making machine. It was capable of producing 200 cigarettes per minute, and it marked the beginning of the mechanization of the tobacco industry. Improvements followed rapidly, so that the modern machine, with the supplementary packing and wrapping equipment, represents the most advanced development of the machinist's skill. Modern machines range in their capacities from 100 to 1,500 cigarettes per minute. Some of the smaller machines

may be operated by hand. The capacities of the larger machines range from 450 to 1,500 cigarettes per minute, dependent upon whether a plain or tipped product is to be made, the length of the cigarette and the character of the tobacco to be rolled. It is equipped with a hopper holding 50 to 135 pounds of cut tobacco, which it delivers as a continuous compact rod upon a strip of paper moving at a maximum rate of 340 feet per minute. The paper strip, fed from a roll, passes over a device which prints the manufacturer's trademark for each cigarette. Passing onto a folder belt, the paper receives the tobacco and continues through a folding device where the tobacco and paper are formed to the desired circumference and shape (round or oval). Starch or casein paste is applied to seal the paper into a cigarette rod, heat is applied to dry the paste, and a cutoff knife severs the rod into proper length. The knife is ingeniously adjusted to make a clean, sharp cut through the rapidly moving rod. The cigarettes drop onto a table where they are inspected by an attendant, placed in trays which hold about 3,800 cigarettes and sent on to the packing machine.

Instead of sealing the paper with paste the machine may crimp the two edges of the paper to make an effective and permanent seal. If desired the cigarettes can be supplied with tips of cork, silk, glazed paper or similar material. These materials, fed from bobbins, are applied by the machine to the paper strip before the tobacco is placed on it. The paper feed is so arranged that the tipping material receives a coating of adhesive on one side, is carried to position, pressed onto the paper and dried by a stream of warm air. Application of the tips to the paper reduces the rate of the high speed machines to about three-fourths of their production of plain cigarettes.

At the packing machines the trays of cigarettes are automatically emptied into a hopper from which they are fed into a compressing pocket where the shape of the package is determined, and the proper number of cigarettes are placed for each row of the package. The standard American package contains 20, although the number may range from 10 to 24 in different brands. The group of cigarettes is formed to proper size and pushed inside a mandrel, around which the foil and paper label have been wrapped. The ends are gummed, folded and sealed, and the package delivered to a runway, and moved under a wheel which applies a revenue excise stamp, when required. Prior to closing the package feeler pins operate to detect missing cigarettes, soft end cigarettes, long or short ones, and any defective package is automatically discarded by the machine. After receiving the revenue stamp the packages move forward to another machine where they are quickly wrapped in cellophane or similar moisture conserving material. They are then packed in cartons. The standard carton contains 200 cigarettes, and the standard shipping case for wholesale distribution contains 10,000 cigarettes.

Classification.—Cigarettes are classified according to the type or types of tobacco used in their blends (see TOBACCO). Where only one type is used such as Turkish or Burley, it may be described as a "straight Turkish" or "straight Burley," although a number of grades of leaf of the one type may be used. The English blend is made entirely of American flue-cured

tobacco, and was so named because of its great popularity in Great Britain and its Dominions. More recently flue-cured tobacco grown in Canada, India and parts of southern Africa, as well as Turkish leaf, acquired under the British Empire preference tariffs or trade agreements, have been substituted in some of the English brands.

Black tobacco cigarettes were preferred for a long time in Cuba, and other parts of the Caribbean area, in South America, Spain, Italy and France. Most of them are made from cigar tobaccos, although fire-cured leaf sometimes may be used. They may be wrapped with white paper, or with brown or black paper of heavier texture, which may carry added flavoring.

The American blend cigarette dominates the American market, and it is becoming increasingly popular throughout the world. It is a mixture of flue-cured, Burley, and Turkish tobaccos in the approximate proportion of 50, 40 and 10 per cent respectively—the proportions varying with different brands. Some brands may replace a part of the Burley type with Maryland tobacco; others may add a small portion of Latakia tobacco grown in Syria, Lebanon, and Palestine. A characteristic of Burley tobacco is its great capacity for absorbing sugar syrups and other flavorings, and it blends well with flue-cured and Turkish varieties to produce the most popular smoking mixture. It affords the largest market for maple sugar, since this sugar is a preferred flavoring for Burley tobacco. The American blend appeared in 1913, and under the impact of modern advertising rapidly achieved a dominant position, which it has maintained with increased production each year since.

"Roll-your-own" refers to those cigarettes which the smoker makes himself. He may use a simple mechanism to roll the paper around a short rod of tobacco, or deftly complete the entire operation with the fingers, moistening the gummed edge of the paper to seal the tube. It is estimated that the consumption of roll-your-own cigarettes equal six to eight per cent of the quantity that are factory made. Corn husks in booklets are still available in certain areas for use on roll-your-own cigarettes. Paper or corn husk wrappers pay an excise tax of one cent per book of 50 sheets. Most papers, however, are distributed with the tobacco in booklets of 24 papers, and in that quantity are tax free.

Manufacture.—The flue-cured, Burley and Maryland tobaccos used in cigarettes are stored in wooden casks or hogsheads. After purchase from the farmer on the auction warehouse floor, the leaf is treated in a conditioning machine of special construction, and the moisture content is made uniform at 12 to 14 per cent throughout the cask. The storage period ranges from one to three years. The Turkish tobacco is imported in bales, and a group of grades from several growing areas may be used to maintain uniformity in the blend from year to year.

When the tobacco is brought to the factory for processing the hogsheads are placed in a long chamber, where, by means of vacuum, moisture is added to prevent breakage and render it soft and pliable for stripping out the midrib or leaf stem, and removing any foreign material and dust. The Burley tobacco is dipped in the flavoring syrups or sauces, pressed lightly, and dried to proper moisture content, and mixed with the flue-cured, Turkish and other types that the manufacturer's formula requires. As many as 15 to

20 grades of any one type may be used to make up the blended mass. The tobacco is cut into shreds 4/10 to 3/4 millimeter in width. A top flavor may be sprayed on the cut, blended leaf, after which it is placed in large boxes, known as Saratogas, holding about 90 pounds, to mull for one to three days or longer, prior to its delivery to the cigarette making machine.

This preparation of the leaf is highly mechanized, and geared to high speed production. It requires close controls of the blend components and the moisture content, so that the shredded tobacco will handle properly on the cigarette forming machine.

The manufacture of "large" cigarettes has decreased rapidly, less than 700,000 being made in 1949. Their manufacture is confined to a few small factories, most of which are in New York City.

Production and Consumption.—The leaf tobacco required to manufacture the 1949 production in the United States was estimated at 1,100,000,000 pounds. The American smokers in that year spent approximately 3 1/4 billions of dollars for cigarettes. Of this sum \$1,232,728,000 represented federal excise taxes, while more than 325 millions of dollars were taken by 39 states which levy taxes on cigarettes. It is estimated that 600 millions of dollars were paid to the growers of the cigarette types of tobacco in 1949. The United States imported for cigarette purposes 60 million pounds of aromatic tobaccos from Turkey, Greece, Bulgaria, Palestine, and Syria, the USSR, and Southern Rhodesia. These imports had an approximate value of 45 millions of dollars.

The annual consumption per capita in the United States is about 2,390 cigarettes. Consumption of cigarettes was greatly stimulated during and after World Wars I and II, as shown in the following table taken from Bureau of Internal Revenue reports. Similar increases in consumption are reported in all countries throughout the world, especially since World War II. About

PRODUCTION OF CIGARETTES IN THE UNITED STATES

1880	532,000,000 small and large cigarettes
1900	3,254,130,630 small cigarettes
1910	8,644,335,407 " "
1912	13,167,093,515 " "
1920	47,430,105,055 " "
1930	123,802,186,217 " "
1940	189,371,258,171 " "
1949	384,979,357,849 " "

nine per cent of the 1949 production was exported or sold to sea stores free of tax.

Production in 1949 was carried on in 53 factories licensed by the Bureau of Internal Revenue. North Carolina led in production with great factories located at Durham, Reidsville, and Winston-Salem. Virginia ranked second with factories located at Richmond and Petersburg, Kentucky was third with Louisville as the center of production. These were followed by New Jersey, California, Pennsylvania, New York and Missouri.

Cigarette paper is a special tissue of highest quality, and of varying characteristics made to meet the demands of the cigarette manufacturer. Papers differ in density, filler, porosity and fire-holding capacity. Most American cigarettes are wrapped in white paper, but the manufacturer can supply papers of various colors and shades, and with flavors added to blend with the tobacco. Flax straw secured from the flaxseed producing areas is the chief ingredient in making cigarette

paper in the United States. For many years the major requirements were supplied by French paper makers, but now factories located in Massachusetts, New Jersey, and North Carolina supply nearly all of the paper used in the United States.

The quality of cigarettes is carefully protected by the manufacturer. Certain chemical correlations, such as nitrogen and nicotine contents, total carbohydrates and sugars are maintained in balanced proportions. Seasonal variations in the tobacco growing areas produce variations in the leaf composition from year to year. The manufacturers maintain laboratories to analyze the leaf in storage, to assist the tobacco expert in the factory in maintaining the composition of the blends, and to test the smoking qualities. Much of the modern cigarette advertising, in attempting to employ chemical values, has distorted the significance of the important components of high-grade smoking tobaccos.

"Low-nicotine" cigarettes are produced by treating the tobacco with solvents, which also remove in the extraction process some of the most desirable aromatic properties of the leaf. Tobacco varieties have been recently developed with low nicotine contents. Some of them lack the more desirable aromatics possessed by normal cigarette leaf, since fine smoking quality is correlated with a nicotine content of two to two and a half per cent, to satisfy the average smoker.

E. G. BEINHART,
Eastern Regional Research Laboratory, U.S.
Dept. of Agriculture, Philadelphia, Pa.

CIGNANI, chē-nyä'ně, **CONTE Carlo**, Italian painter: b. Bologna, May 15, 1628; d. Forlì, Sept. 6, 1719. A pupil of Francesco Albani's, he was greatly influenced by Guido Reni, Agostino Carracci, and especially Correggio, as borne out in his painting *The Assumption of the Virgin* at Forlì where he imitated Correggio's cupola fresco at Parma. His outlines and drapery possess an elaborate finish and his color and composition have that artificiality common to those he admired and imitated. Other fresco paintings of note are *François I Touching for King's Evil* at the Farnese Palace, the ovals supported by angels at Parma, and the frescos at San Michele in Bosco. Clement XI conferred on him several marks of distinction.

CIGNAROLI, chē-nyä-rô'lě, **Giovanni Bettino**, Italian painter: b. Verona, July 4, 1706; d. there, Dec. 1, 1770. One of the better Veronese historical painters, he was founder and director (1769) of a famous school of painting at Verona. His greatest painting is *Flight into Egypt* at Parma, and others include *Death of Rachel* at Venice, *Madonna with Saints* at Vienna, and *Transfiguration* at Verona. He is also known for his mythological works which appear at Bergamo and Ferrara. Influenced greatly by the works of Guido Reni and Correggio, he was himself a man of literary culture, writing with discrimination and taste on various subject.

CIGOLI, chē'gô-lě, **Lodovico Cardi da**, Italian painter and architect: b. Castelvécchio, Sept. 21, 1559; d. Rome, June 8, 1613. He studied painting under Alessandro Allori in Florence and architecture under Bernardo Buontalenti. His most celebrated picture, *St. Peter Curing*

the Lame Man, formerly adorned St. Peter's at Rome. Other paintings of note include *Martyrdom of St. Stephen*, *St. Francis Receiving the Stigmata*, and his most famous *Ecce Homo*, all at Florence; *Nativity* at Pistoia and *Story of Cupid and Psyche* at the Villa Borghese, Rome. He is especially renowned for having originated the baroque style of painting in Florence.

While not so prominent in architecture as in painting, he did design the façade of Santa Maria del Fiore, Florence; the entrance of the Salvati Chapel, San Marco, Florence; and several Florentine courts.

CILIA, sîl'i-à (Lat. *cilium*, eyelid), small, generally microscopic, hairlike organs or appendages, found on the surface of the tissues of most animals and in some vegetable organisms (as algae), chiefly on tissues which are in contact with water, or which produce fluid secretions. They are constantly in a state of active movement, and communicate to the fluid with which they are in contact a corresponding motion, called a vibratile or ciliary motion. In certain forms of free-swimming unicellular animals, this motion provides a means of locomotion.

CILIATA, sîl-i-ă'tă, a group of Protozoa, and to which belong most of the Infusoria (q.v.)

CILICIA, sî-lish'i-ă, in ancient geography the maritime country between Pamphylia on the west and Syria on the east, lying south of the Taurus Mountain range along the extreme north-eastern area of the Mediterranean Sea. The inhabitants of the northern portion lived in part a nomadic life while those in the east, on the fertile plains, were devoted to agriculture. In modern Turkey this district is known as Lesser Armenia and contains part of the vilayets of Seyhan and Maraş and the entire vilayet of İçel. The population is about 540,000, of whom many are Armenians.

History.—First conquered by Cyrus and made a satrapy of the Persian Empire, it was invaded by Alexander the Great in 333 B.C. who made it a Macedonian province and colonised it with Greeks. It fell to the Syrians after Alexander's death and the coast became inhabited with pirates who often raided as far as the Aegean and Ionian seas. They were eventually subdued by Pompey who, in 62 B.C. made most of Cilicia a Roman province, of which Marcus Tullius Cicero was proconsul in 51–50 B.C. It was invaded by Arabs in 710–711 A.D. and became part of the Byzantine Empire for some years. In 1080 the Armenians, who had been driven from their native land, set up an independent principality here which was called Little Armenia. It became a kingdom in 1198 and was conquered by the Mamelukes in 1375, eventually becoming part of the Ottoman Empire. It was the scene in 1909 of extensive massacres of the Christian Armenians by the Moslem Turks.

CIMABUE, chē-mă-bōō'ă, **Giovanni** (properly **CENNI DI PEPO**, chān'ně dē pā'pō), Florentine painter and mosaicist: b. Florence, Italy, c.1240; d. Pisa, c.1302. The 20th century has claimed for Cimabue the recognition in Italian art that he first won seven centuries ago. Research has at last established the identity of his great works, so long a cause of contention.

The first outstanding Florentine painter, he

lived in that period when art was as profitable as any industry. Florence was the wealthiest city in Europe, and painters were in demand. Yet there were no exhibitions or museums. The buyer simply went to the artist's workshop to order what he wanted, which made the painter's lot a favored one. The guilds were largely responsible for this. No man could get work unless he belonged to a guild, but a high quality of skill was demanded of each member. The artist had to live up to his written contract. As for the buyer, he had to pay in full—or be sued or jailed.

Cimabue first worked in the old Byzantine style, conventional and flat. Loyal to this form, though not content with it, he was constantly experimenting. Religious passion had to be expressed in narrative art for the church. Those who could not read could thus understand the Bible stories in paintings. Always hoping to make the Bible more comprehensible, Cimabue gradually gave up the Byzantine tradition, and through him the Florentine school emerged. Life and emotion were coming into Italian painting.

According to a traditional account, Cimabue was walking along a country path when he saw a boy skillfully drawing on a large flat stone. He was sketching sheep—drawing from life, a new feat for those days. Attracted by such unusual talent, Cimabue took the boy as his apprentice. This apprentice and pupil became the famous Giotto, who soon surpassed his master and laid the foundation for much of Western art.

Cimabue traveled from town to town decorating churches. Florentine painters were the best in Italy, and this energetic artist had more offers than he could accept. About the year 1290 he was assigned the tremendous task of decorating the church of San Francesco in Assisi. His part was the choir and transepts of the upper church, and the four evangelists in the cross vault. On the walls he gave the stories of St. Peter and St. Paul, and the legends of the Virgin scenes from the Apocalypse. His *Madonna Enthroned* is in the Uffizi Gallery in Florence. He was working on the apsidal mosaic at Pisa when he died.

CIMAROSA, chē-mā-rō-zā, **Domenico**, eminent Neapolitan dramatic composer: b. Aversa, near Naples, Italy, Dec. 17, 1749; d. Venice, Jan. 11, 1801. Cimarosa was Gluck's greatest contemporary among the Italians. With a facile style his operas were produced in such rapid succession that he was soon a rival of Giovanni Paisiello, then the king of opera. Even the famous Mozart suffered a partial eclipse when Cimarosa's later dramas were presented. Yet his life began with no fanfare.

The son of poor parents, he was orphaned as a young boy. Educated at a charity school, his musical talent was so marked that he was awarded a scholarship to the excellent Conservatorio Santa Maria di Loreto, where he remained for 11 years (1761–1772). He studied with celebrated teachers, learning singing from Gennaro Manna and Antonio Sacchini, counterpoint from Fedele Fenaroli, and composition from Niccolò Piccini.

His first opera, *Le stravaganze del conte*, was produced in Naples in 1772 with mediocre results. But the following year he brought out his brilliantly successful *La finta pargina* in Naples, and was then proclaimed a great composer.

Until 1781 he divided his time between Rome

and Naples, composing for each city, which was the custom of the day. 'As a masterstroke he presented two operas in Naples, one in Rome, and two in Turin. This spread his fame to all of Europe. His works were translated into other languages and performed abroad. In Vienna the emperor preferred the fluent Italian style to that of the German operas. He assembled an Italian company for *opera buffa* and Cimarosa provided many of the dramas. At this time Italian opera was so popular that even Mozart could not enter the competition, as his works were German.

Cimarosa went to St. Petersburg in 1789 as court composer and remained three years, composing three operas and 500 pieces of music for the court. His music was praised by the people, but Catherine the Great was not satisfied with his choral works. His real talent, of course, lay in comedy—the genuine Italian *opera buffa*.

He became imperial choirmaster in Vienna in 1792 at a fabulous salary, and here in the same year he wrote his masterpiece, *Il matrimonio segreto*, the only one of his 120 dramas that is still performed. So instantaneous was its success that it was repeated on the night of its first performance. After Cimarosa's return to Naples in 1793, the opera was presented 67 times in succession, and some critics said that it excelled Mozart.

The Italian composer's troubles began in 1799 when the French Army entered Naples, for he made no secret of his sympathy with the revolutionists. Because of this he was imprisoned and condemned to death—a sentence commuted to banishment at the insistence of the masses. But Cimarosa's spirit never recovered from his prison experience. While in Venice working on his new opera *Artemisia*, he died suddenly. A persistent rumor that he had been poisoned by Queen Caroline's orders because of his revolutionary views aroused general concern, and the pope's physician was sent to examine him. According to his sworn statement Cimarosa died of a gangrenous condition.

Besides his operas he wrote symphonies, requiems, masses, cantatas, motets, and oratorios.

CIMBRI, sim'bri, a tribe believed to have inhabited Jutland; with the Teutons they became enemies of Rome. In 113 B.C. masses of these barbarians overcame a Roman army in Noricum. They did not enter Italy but moved north to attack. The Romans sent two armies, but both were defeated. The victors then overran Gaul. Two new Roman armies were sent, but even they could not destroy them, and the Romans lost some 80,000 men in the conflict.

Hence arose the so-called Cimbrian Panic at Rome, where they feared an immediate invasion of Italy; but the Cimbri descended into Spain, whence the Celtiberians repulsed them.

Finally they stormed into Italy. But Gaius Marius had spent three years preparing for such an attack, and they were routed near Vercellae in the Po Valley (101 B.C.).

The nationality of the Cimbri is disputed. Some authorities believe they were Germanic; others say they were of the Celtic race. Their name certainly resembles the Celtic Cymry, and, according to Strabo and Plutarch, their armor and customs were very unlike those of Germany.

CIMICIFUGA, sim-ī-sif'ū-gā, from the Latin "to drive away," so named because cer-

tain species are used to drive away bugs and other insects. The plant is a genus of the crow-foot family, comprising about 20 species, natives of North America, Asia and Europe. The best known American species, because of their medicinal properties, are the bughane (*Cimicifuga americana*) (q.v.) and the black snakeroot or black cohosh (*C. racemosa*), supposed to be an antidote for the venom of serpents.

CIMMERIAN BOSPORUS, sî-mēr'î-ân bôs'pō-rūs, an ancient name for Kerch Strait.

CIMMERIANS, a tribe half-mythical, half-historical, described first in the Odyssey as dwelling beyond the ocean-stream, in thickest gloom, unvisited by Helios. Hence the term, "Cimmerian gloom." From Herodotus we learn that they originally inhabited the country between the Borysthènes and the Tanais, but expelled by the Scythians, they traveled along the shores of the Euxine, passed through Colchis and over the Halys, and entered Asia to the west of that river. Against this it is urged that the route by the Euxine would be impassable for a nomadic people, the Caucasus running down to the very shores of that sea. The sum of our certain knowledge respecting this people is, that they seem to have been the chief occupants of the Tauric Chersonesus (the Crimea), where they had a large city, near which were fortifications enclosing the isthmus by an earthen wall.

CIMON, kî-môn, Athenian general and statesman: b. about 502 B.C.; d. Citium, Cyprus, 449 B.C. He was a son of the great Miltiades. He fought against the Persians in the battle of Salamis 480 B.C., and shared with Aristides the chief command of the fleet sent to Asia to deliver the Greek colonies from the Persian yoke. The return of Aristides to Athens soon after left Cimon at the head of the whole naval force of Greece. He conquered the pirate-island of Scyros, subdued all the cities on the coast of Asia Minor, pursued the Persian fleet up the Eurymedon, destroyed more than 200 of their ships, and then, having landed, on the same day entirely defeated their army 469 B.C. He employed the spoil which he had taken in the embellishment of Athens, and in 463 reduced the revolted Thasians; but the popular leaders, beginning to fear his power, charged him on his return with having been corrupted by the king of Macedon. The charge was dropped, but when Cimon's policy of friendship to the Lacedaemonians ended in the latter insulting the troops sent by Athens to their aid, his opponents secured his banishment. He retired into Boeotia, and his request to be allowed to fight with the Athenians against the Lacedaemonians in 457 at Tanagra was refused. Eventually Cimon was recalled at the instance of Pericles to conclude a peace with Lacedaemon. He died while besieging Citium in Cyprus. His *Life* was written by Cornelius Nepos.

CINCHONA, sîn-kō'nā, **BARK**, the bark of several species of *Cinchona*, a genus of trees and shrubs of the family Rubiaceae. The following are the most important: *Cinchona flava cortex*, yellow cinchona bark, which occurs as quills covered with a brown epidermis, mottled with whitish yellow lichens, and also in flat cinnamon-colored pieces. They break with a fibrous fracture and the escape of a powder. Yellow bark is

rich in quinine, and 100 grains should yield not less than two grains of alkaloid. It is derived from *C. calisaya*, which grows in the peculiar cloudy regions of the Andes; *C. pallida cortex*, pale cinchona bark, from *C. officinalis*. It occurs always in quills covered with crustaceous lichens. Its fracture is short and not fibrous. It contains chiefly cinchonine. Two hundred grains of the bark yield about one grain of alkaloid. *C. suc-cirubra*, a native of Peru, appears to thrive in India. The bark occurs in flattened rough-fibrous, dark brown red pieces, which are covered with a brown-red epidermis. It breaks with a red fibrous fracture. It contains about equal quantities of cinchonine and quinine, and 100 grains of the powdered bark should yield not less than one and one half grains of alkaloid. The yellow bark is used in the form of decoction, extract, infusion and tincture. The pale bark is contained in *tincture cinchonae composita* and in *mixture ferri aromatica*. The cinchona barks contain, besides the alkaloids, certain acids having astringent properties, and are valuable as tonics in cases of great debility. Cinchona barks rich in quinine generally contain much lime, and their solutions are precipitated by sodium sulphate. See also QUININE.

CINCINNATI, Ohio, city and Hamilton County seat, on the Ohio River; 110 miles southwest of Columbus and, by river, about midway between Pittsburgh, Pa., and Cairo, Ill.; area 72.4 square miles. It is a river port and a port of entry (41st Customs District). It has boat connections with river ports and is served by eight railroads. It is a commercial and manufacturing center. In 1947, it ranked 14th among metropolitan areas of the United States in the value of its manufactures, and in its own state was surpassed by Cleveland alone. The city's population in 1950 was 503,998.

Topography.—Cincinnati's average altitude is about 540 feet. The city occupies the northern half of a circular amphitheater of hills about two and one half miles in diameter, bisected east and west by the Ohio River, which here makes a sharp southward sweep. The southern half of the hills is bisected north and south by the Licking River in the Kentucky suburbs. The northern semicircle rises from the river in two great terraces sloping northward to a third level at the summit, originally quite distinct but now much confused by grading. The lower platform is a bluff, about 65 feet above low water; the second, 50 to 100 feet higher. The crest hills (Mount Adams, Price Hill, Mount Auburn, Mount Washington, for example), 15 to 300 feet higher yet, are about 800 feet at the summits. The last of the original five inclined plane lines, built in the latter part of the 1800's for vehicular travel to these hills, ceased operation in 1949. The ravines that cut the hills, originally heavily wooded, are now replaced by residential areas overlooking the city. On the western side of the city from north to south runs Mill Creek, the remains of a once huge glacial stream. Its gently sloping valley, a half mile or more wide, forms an easy path into the heart of the city and was an indispensable factor in determining its position. The site of the city is a glacial moraine of gravel and boulders, traversed by the Ohio River. A moderate climate contributes to the city's advantages as a healthful place of residence. Temperatures average 75°F. in summer and 34°F. in winter. Pre-

precipitation is rather evenly divided over the year, ranging from an average high of 3.9 inches in March to an average low of 2.4 inches in October.

In 1950, the city extended for about 25 miles along the river front to a width of about 15 miles in an irregular block north from it. The standard metropolitan area of Cincinnati (as used by federal statisticians) includes all of the county in which it lies, as well as Campbell and Kenton counties in Kentucky. The river level is the site of the shipping business. It is called the Basin and contains some blighted areas. Here (at the foot of Broadway) are the Public Landing, a municipally-operated floating dock, and wharf boats. Three railroad bridges span the Ohio; those used by the Louisville and Nashville, the Chesapeake and Ohio, and the Southern railroads. Other bridges are the Central Bridge and the Ohio River Suspension Bridge (span, 1,057 feet). Of these five, the first two railroad bridges (which are also utilized for highway traffic) and the Central Bridge are owned by Kentucky. The next level above the river bank contains warehouse facilities and, above it, is the downtown retail business district. Beyond and above the business district are the residential sections; then, the many spacious and attractive suburbs such as Walnut Hills, Hyde Park, and Westwood.

Industry and Business.—Meat packing is one of the city's major industries, and meat products accounted for \$14,720,000 of the city's total production in 1947. The Procter and Gamble Company and the Andrew Jergens Company, with home offices in Cincinnati, provide a large part of the world's supply of soaps, detergents, and cosmetics. In 1949, the Procter and Gamble Company alone manufactured soap and allied products valued at \$696,670,926. Cincinnati claimed the distinction of being the world center for making milling machines, lathes, and planers; drilling, grinding, and cutter-sharpening machines; shapers and boring mills. In the field of mechanics, Cincinnati has a long and illustrious history. The Ohio River which in the beginning of Cincinnati's metal trades industry in the early 1800's, brought the iron ore and the coal needed to cast and forge the metal, eventually drove many of the metal fabricators away from its banks by a series of floods. Since 1947, when Mill Creek Barrier Dam was completed by army engineers at a cost of \$10,000,000, Cincinnati's industries have been safe from high water, though some (including the world's largest machine tool plant, belonging to the Cincinnati Milling Machine Company) are located in the suburbs, far from the rampaging Ohio. In 1947, out of an average total of 108,476 production workers in the Cincinnati area, 24,479 were engaged in producing machinery; 11,339 in fabricated metal products; and 5,363 worked in the primary metal industries.

Other Cincinnati industries also have a claim to fame. The Globe-Wernicke Company at Norwood, Ohio (in Cincinnati's metropolitan area), is one of the largest manufacturers of office equipment and filing supplies in the United States. Cincinnati has long been a printing and publishing center. The famous *Eclectic Readers* of William Holmes McGuffey (q.v.) were first published by a Cincinnati firm in the 1830's. In 1947, more than 12,000 employees were engaged in printing and publishing. Cincinnati's products of these industries include everything from playing cards made by the United States Playing Card Company (the largest of its kind in the world) to 75

major magazines, and almost every kind of industrial publication, particularly insurance manuals. Cincinnati is the home office for three great insurance companies, and is the largest of the inland bituminous coal trading centers of the United States. It is also one of the important brewing and distilling centers; in 1947, its product in malt liquor alone was valued at \$25,652,000.

As early as 1821, Cincinnati had 31 workers' "societies." The first real trade union in Ohio (Franklin Typographical Union) was organized there in 1828; and, in 1831, one of the first labor newspapers in the United States, the *Working Man's Shield*, was issued in the city. It was in Cincinnati, too, that the first large company in the United States (the Procter and Gamble Company) gave its employees Saturday half-holidays. About the same time (1887) the company also inaugurated the first of a series of plans for profit-sharing with its employees.

Government and Population.—Cincinnati is termed by some authorities on municipal government the "best governed city." It is especially proud of that designation because in the early 1900's it was often called the worst governed. When it was revealed in 1922 that the city was virtually bankrupt, having one of the lowest tax rates but the 4th highest per capita expenditures among the larger cities of the United States, a reform group (a coalition party of Democrats and Republicans), was established and began a movement for a new city charter. It won the election in 1924, defeating the opposition by a vote of 92,510 to 41,015. Under the new charter, which has since governed the city, the old council of thirty-two members has been replaced with a group of nine, each elected for a two-year term. The charter also provides that the council members themselves elect one of the nine as mayor, who acts as the chairman of the group and as the city's official greeter. The council, elected by proportional representation, hires a city manager to conduct the business of the city and implement council's decisions. The new charter also instituted civil service examinations for city employees. Cincinnati councilmen receive a salary of \$5,000 per year and \$1,000 additional for the mayor. The city manager receives \$25,000 a year. In the 12 councilmanic elections held between 1926 and 1948 under the new charter, the so-called Charter Party retained control for seven terms; the Republican Party had a majority for three terms, while an independent had the deciding vote for two terms in an equally divided council.

Though there are more than a million persons living within a 20-mile radius of downtown Cincinnati, only about half of these are under the jurisdiction of Cincinnati. In Hamilton County, which has an area of approximately 414 square miles, there are 12 townships, 7 cities (including Cincinnati), 6 health districts, 25 villages, 44 school districts, 1 library district, and 1 county park district. If the over-the-river communities in Kentucky that are less than 10 miles from downtown Cincinnati were added, the number of political subdivisions would be almost doubled. Like many another large city, one of Cincinnati's problems is how to eliminate or reduce the waste these overlapping governments incur.

The Cincinnati Master Plan, completed in 1948 at a cost of \$250,000 provides a blueprint for the city's development and for the coordination and redistribution of the traffic of a city that, like many others, finds its existing transportation facil-

ities inadequate. Among the improvements contemplated in the plan are motorways, industrial areas, recreation, public transit, urban redevelopment, river front redevelopment, and airports (including a master airport at Blue Ash, a few miles north of the city). The plan's ultimate completion is figured on an annual schedule by five-year stages, serving as a basis for the proposal of bond issues to finance the projects as they are submitted yearly to the voters.

Transportation and Communications.—

The Ohio River is the great, natural channel for the flow of commercial currents through one of America's most fertile and productive regions. Locks and dams have increased river traffic for heavy freight, such as coal, lumber, iron, steel, sand, cement and, since 1948, for the transportation of new automobiles by barge to southern distribution points. Cincinnati's annual millions of dollars of commerce are divided between river barges, steam and diesel towboats, freight trains, and motor trucks. Cincinnati acquired the distinction of owning a railroad after the Civil War. To offset the threat of railroads to Cincinnati's freight business with the South, a right-of-way was acquired by the city to Chattanooga, Tenn., 339 miles away. The Cincinnati Southern Railroad was completed in 1880 and, still city-owned, is operated under lease by the Southern Railway Company. The seven other railroads which serve Cincinnati are the Baltimore and Ohio, the Chesapeake and Ohio, the New York Central, the Louisville and Nashville, the Norfolk and Western, the Pennsylvania, and the Erie. It is also served by three major national highways. As of 1950, Cincinnati's airport facilities included the Greater Cincinnati Airport (located across the river in Kentucky) for major passenger airlines, Lunken Airport for air freight and private planes, and a number of lesser ports in the outlying suburbs. Cincinnati had five radio and three television stations in 1950 and three daily newspapers.

Education.—As of 1950, Cincinnati's public school system included 5 senior high schools, 6 junior high schools, 63 elementary schools, and 4 vocational high schools. Late afternoon and evening classes are held at the city's high schools as part of the adult education program. One school offers a regular school program adjusted to the needs of handicapped students. Sight-saving classes and courses in Braille are offered in the regular elementary and junior high schools. There is a school for the deaf and two elementary schools have classes for the hard of hearing. The Catholic archdiocese has a parochial system of elementary and high schools. The University of Cincinnati (see CINCINNATI, UNIVERSITY OF) dates back to Cincinnati College, founded in 1819. The university received its charter as a municipally-owned institution in 1874. It includes ten colleges, a summer school, and an evening college. The idea of the cooperative system of technical education (class room study combined with job experience) originated at the university. This idea, which has since been adopted by many other institutions in the United States and in other countries, is now used in Cincinnati's vocational high schools, also. Cincinnati is the home of Xavier University, the oldest Catholic university in Ohio, having been founded in 1831 by the Society of Jesus. Xavier's seismological observatory is one of the few in the United States. Among other Catholic institutions of higher

learning in the archdiocese of Cincinnati are Our Lady of Cincinnati College, College of Mount St. Joseph-on-the-Ohio (both for women), St. Gregory Minor Seminary, and Mount St. Mary Seminary of the West. The Ohio Mechanics Institute, founded in 1829, gives courses in mechanical trades and arts, and houses an industrial museum. The Art Academy (1869) of the Cincinnati Art Museum offers courses in drawing, painting, and sculpture. The Hebrew Union College, founded in 1875, oldest Jewish theological school in the Americas, has curricular affiliations with the University of Cincinnati. Courses in music are available at the Cincinnati Conservatory of Music (1867) and the College of Music; there are other specialized schools.

Libraries and Museums.—The Hamilton County (public) Library, with its main building in Cincinnati and branches scattered throughout the city and county, had about a million and a half volumes in 1950. It also owned valuable special collections such as Bibles, first editions of Audubon prints, books printed in or published about Cincinnati and the Ohio River Valley, as well as a letter written by Christopher Columbus. The library of the Historical and Philosophical Society of Ohio has priceless collections of local newspapers, letters and diaries of Cincinnati's early settlers, and historical pictures of the city and its activities. Other important libraries are those of the University of Cincinnati, with more than a half million items, including a collection of Stephen Foster memorabilia; and of Xavier University, housing about 56,000 bound volumes and manuscripts. The Bernheim Library of the Hebrew Union College is chiefly noted for its thousands of manuscripts and more than 100,000 volumes of Judaica and Hebraica. The Hamilton County Court House has an unusually complete law library; while the Mercantile Library, founded in 1853 and still operating under its original 10,000-year lease, has 124,000 volumes including a priceless collection of early Cincinnati directories. The Cincinnati Art Museum in Eden Park was opened in 1886 and has been greatly enlarged. In 1950 it had an art library, 50 exhibition rooms and galleries, and an auditorium seating 500. It is the home of Cincinnati's Civic Theater. The museum contains paintings of Gainsborough, Titian, Franz Hals, Rembrandt, and other masters, in addition to the best collection of paintings by Cincinnati's own Frank Duveneck (q.v.). In the former home of the Charles Phelps Taft family is the Taft Museum, with collections of enamels, jewelry, ceramics, and other objects of art, as well as paintings by Corot, Millet, Goya, Reynolds, and Turner. This museum (a gift to the city from Mr. and Mrs. Taft) was opened in 1932.

Buildings.—Notable among Cincinnati's interesting buildings is the Union Terminal (1933). Representing an investment of more than \$40,000,000, it is an impressive combination of beauty and utility. The city hall (1893) has stained glass windows picturing events in local history. The city owns the Cincinnati Music Hall and Exposition Building (1876) where concerts are given and conventions are held. The Cincinnati Gardens, completed in 1949 at a cost of \$3,500,000, has a seating capacity of 15,000 for conventions, sport events, other forms of entertainment ranging from rodeos to ice shows; and is the home of Cincinnati's ice hockey team, the Mohawks. The Terrace Plaza Hotel (1948), which

CINCINNATI



Above: View of Cincinnati looking across the Ohio River from Covington, Kentucky. At left is the suspension bridge used for motor traffic. The tallest building is the Carew Tower.

Right: Aerial view of a section of the business area. In the foreground is the Terrace Plaza Hotel, the lower part of which is a department store. Six of its floors are windowless.

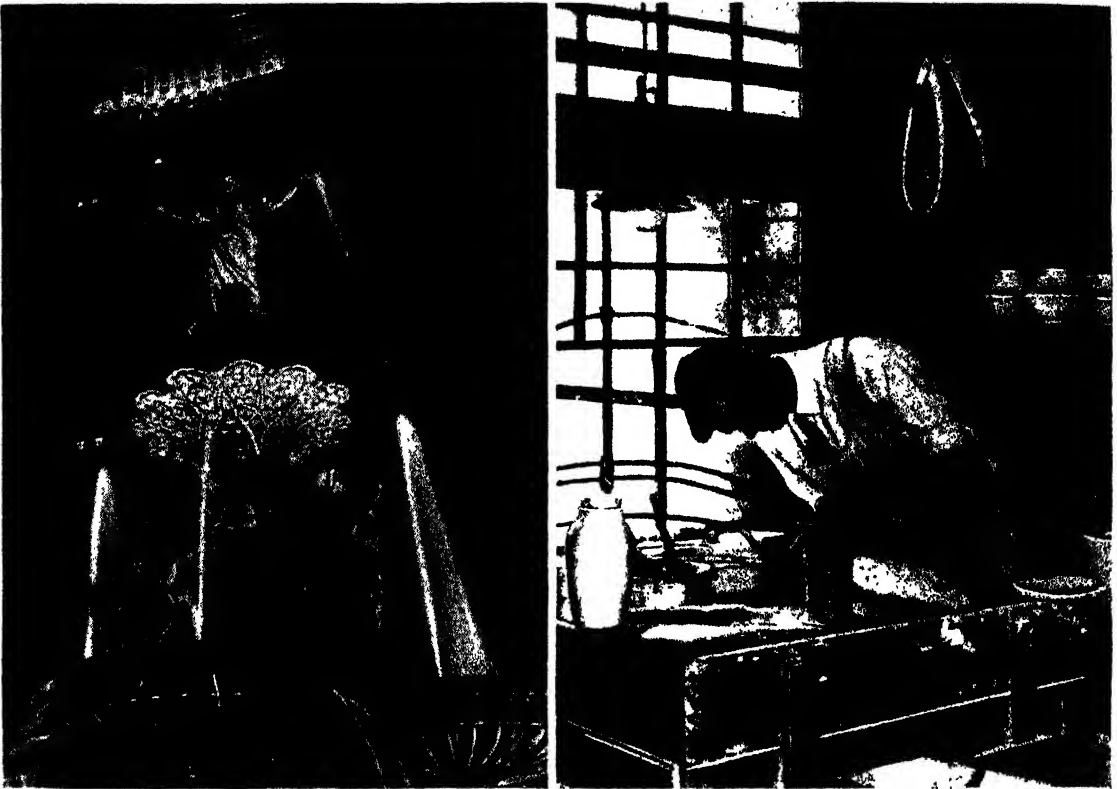


Below: Union Terminal accommodates 17,000 people and more than 100 trains daily. Eight trunk-line railroads serve the city.

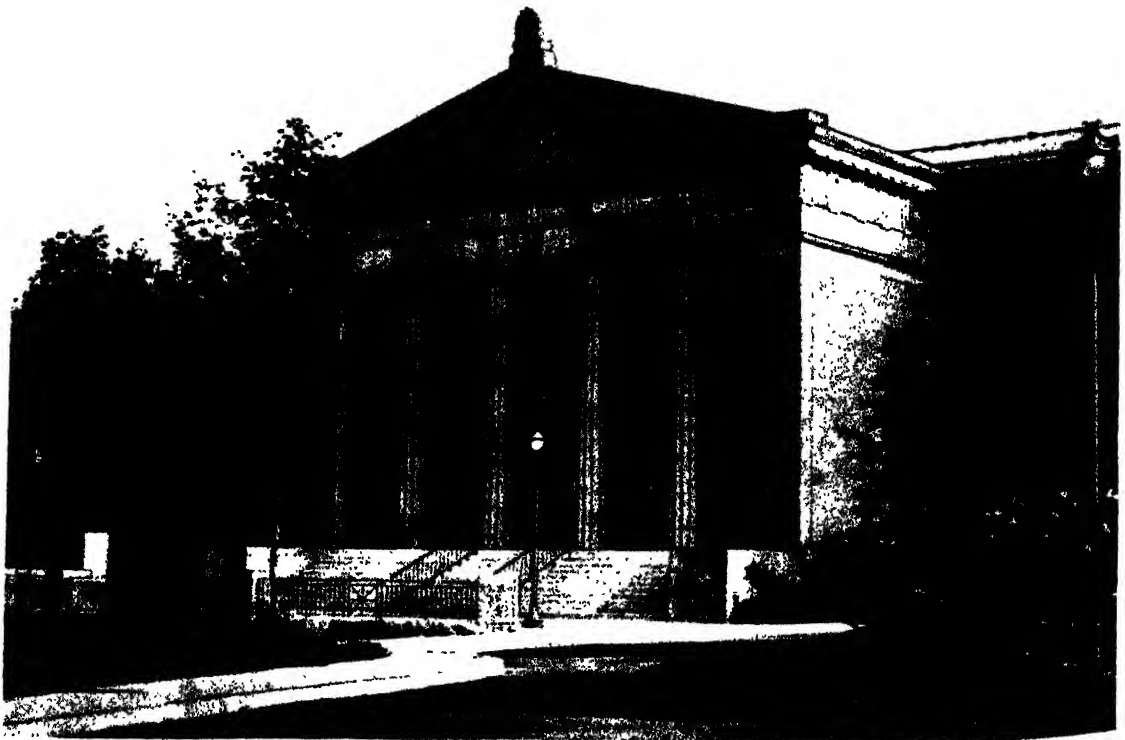
Photos (top) © Ewing Galloway; (right) courtesy Cincinnati Chamber of Commerce; (below) courtesy Louisville and Nashville Railroad



CINCINNATI



Above left: Night lighting on Tyler Davidson Fountain and Carew Tower in background. The fountain is in the center of the city on Fountain Square. The 15 bronze figures were cast at the royal bronze foundry at Munich, Germany. The base is of porphyry. Above right: A worker at the Rookwood pottery, first in the United States to produce artware exclusively. Below: The Cincinnati Art Museum in Eden Park contains rare collections of sculpture, paintings, etchings, textiles, ceramics, metal work, carvings, costumes, arms, and musical instruments.



Photos courtesy Cincinnati Chamber of Commerce

is also a business and shopping center, is one of the most striking examples of modern urban architecture of the period 1945-1950. Six of its floors are windowless. The building is reputed to have cost more than \$15,000,000. Laurel Homes, a slum-clearance project of the 1930's covers 16 blocks with apartments for 1,039 families, and Lincoln Court is one of a number of housing projects of the 1940's for Negro families.

Parks.—Cincinnati's park system covers more than 3,500 acres, with three major parks on the hills and a number of smaller ones throughout the city. The largest, Mount Airy Forest, has an area of more than 1,300 acres, with picnic grounds, riding paths, trails, and an arboretum. Ault Park (230 acres) and Alms Memorial Park (85 acres) afford fine river views. Eden Park (185 acres) in the northeastern section of the city consists of lawns, drives, and a lake which is part of the city's water supply system. It contains a conservatory with rare plants, and the Cincinnati Art Museum and the Art Academy are within its limits. Cincinnati Zoological Gardens are in a park-like setting with the zoo planned to show the animals in surroundings resembling as nearly as possible their natural habitat. In 1950, the city maintained 68 public neighborhood playfields. Coney Island Park is a 140-acre amusement center about 10 miles up the Ohio River. It was virtually destroyed in the flood of 1937, but was rebuilt that year with the use of wrought iron and steel to withstand damage from future floods.

Observatories.—In addition to Xavier University's seismological observatory, Cincinnati has the University of Cincinnati's astronomical observatory, the cornerstone of which was laid in 1843. The United States Weather Bureau's Cincinnati branch is called Abbe Observatory, honoring Cleveland Abbe (q.v.) astronomer and meteorologist, who became director of the observatory in 1868 and established the first weather service there in 1869.

Churches and Charities.—Among the scores of Cincinnati church buildings, some of the more notable are St. Monica's Cathedral, with bell tower; St. Francis de Sales' Church, with lofty spire and campanile; St. Peter in Chains Church (The Old Cathedral, built in 1845, which houses a copy of Murillo's painting, *The Liberation of St. Peter*, the original of which is in Mount St. Mary Seminary); Christ Episcopal Church, designed after old Stepney Church, London; Avondale Synagogue, its windows symbolically picturing the Hebrew holidays; St. Paul's Protestant Episcopal and St. Paul's Methodist Episcopal churches, the New Thought Temple and the Church of the New Jerusalem (Swedenborgian). Private benevolence, organized welfare, and municipal provision for general well-being have equipped the city for dealing with most alleviable human misfortune. In 1915, a community chest system was established. The Cincinnati General Hospital, completed in 1915, has 25 buildings with grounds covering 27 acres. The medical college of the University of Cincinnati is affiliated with this institution. Other hospitals are Bethesda, Children's, Christ, Deaconess, Good Samaritan, Holmes, Jewish, Longview, St. Francis, St. Mary's, and Mercy.

Music and Entertainment.—Beginning with its first singing school in 1796 (when the population was less than 1,000), music has always been an important factor in Cincinnati community

life. Several choral societies were organized in the second decade of the '1800's, and an annual Sängersfest was begun in 1849. The first May (musical) Festival was organized by Theodore Thomas in 1873. This biennial festival was held in the odd-numbered years until World War II interrupted the schedule; it is now held in the even-numbered years. Cincinnati's symphony orchestra, established in 1895, gave the city symphony concerts. Cincinnati also has annual summer and winter seasons of opera, and choral observances at Christmas time. Among Cincinnati's other annual events are a folk dancing festival, June song festival, a Hallowe'en carnival, a Good Friday pilgrimage up Mount Adams to the Catholic church of Immaculate Conception and Our Lady of Lourdes grotto; as well as art exhibits, a dahlia show, a rose show, a county fair, a pure food show, and a dog show.

History.—Cincinnati began as part of the Miami Purchase (see OHIO—History), between the Miami and Little Miami rivers in the Northwest Territory. In 1788, opposite the Licking River, Mathias Denman, Robert Patterson, and Israel Ludlow platted a town three quarters of a mile square (bounded today by Central Avenue, Broadway, Seventh Street, and the Ohio River). They called it Losantiville, a complicated combination of Latin, Greek, French, and Delaware Indian—the whole meaning "town opposite the mouth of the Licking River." The first settlers were brought in the same year. Trouble with the Indians in the Northwest Territory prompted the federal government to build Fort Washington just outside Losantiville's boundaries in 1789; and in 1790, Gen. Arthur St. Clair, newly-appointed governor of the territory, arrived. He laid out Hamilton County, naming it after Alexander Hamilton; made the new town its seat; and changed its name to Cincinnati, in honor of the famous society of officers of the American Revolution. (See CINCINNATI, SOCIETY OF THE.) By the end of 1790, Cincinnati had some 40 log houses. The first church (Presbyterian) was built that year, and the first school (pay) was opened with 30 scholars. Defeat of the militia by the Indians in 1790 and 1791, however, nearly caused the abandonment of the settlement; the fort's importance kept it alive. By 1792, 34 of its buildings were well-stocked warehouses, evidence of its commercial strength even then. *The Sentinel* appeared in 1793, one of the first papers west of the Allegheny Mountains. Canoe mail service to Pittsburgh began in 1794, and a keel boat packet line to the same city was organized. Cincinnati's population was 500 in 1795 and among its log cabins there were already some frame houses. In 1802, Cincinnati was incorporated as a town; by 1810, with a population of 2,300, it was the largest town in the state. In 1819, the town received a city charter. According to the first directory published that year, it had 9,873 inhabitants, mostly from the Northern and Middle states, but including also many foreigners. A book by Dr. Daniel Drake (q.v.), descriptive of the city in 1815, was translated into German. It is believed to have been instrumental in attracting to Cincinnati a large number of immigrants, especially Germans. The city's great development, however, came with the opening of the Miami Canal, the most important single influence in the history of Cincinnati. Ground for the canal was broken in 1825 at Middletown, Ohio, and the canal was completed to Cincinnati

in 1827. The canal helped to develop commerce, and also furnished water power for manufacturing. In 1846, a railroad connected Cincinnati with Columbus and Cleveland. From 1840 to 1859, population jumped from about 46,000 to 160,000. The influence of German immigration made it for years a typical German city. The advent of the Civil War found Cincinnati on the border line physically and politically. Located between the North and South, it was dependent on Southern trade yet was the site of a chief station on the Underground Railroad. When war actually broke out, Cincinnati became a strong Union city. Despite the collapse of the South, the city's postwar commerce boomed. It still looked south for trade. The Suspension Bridge, connecting the city with Kentucky, was opened in 1867. The city-owned railroad, connecting it with Chattanooga, Tenn., was completed in 1880. It was this latter move which saved the city's trade, desperately hard pushed by the successful competition of railroads with river transport. The 1900's saw Cincinnati a prosperous city which felt the national depression of the 1930's less than many of its sister cities. The year 1937 brought both fire and flood, but the city recovered from these disasters. In 1939, it had 72,401 production workers in its manufacturing plants turning out goods valued at \$269,017,000; in 1947, there were 108,476 such workers and the value of the product was \$777,201,000.

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E. LEO KOESTER,
Cincinnati Chamber of Commerce.

CINCINNATI, The Society of the, oldest military society in America. Organized at the proposal of Maj. Gen. Henry Knox on May 10, 1783, at the close of the American Revolution by officers of the American Army (Continental Line) in cantonment at New Windsor near Newburgh, N. Y. Officers of the Continental Navy and French military and naval officers who had served with the American forces also participated in the organization of the society. The patriotic and charitable purposes of the society, as set forth in its Institution, adopted May 13, 1783, were: to perpetuate the mutual friendships formed during the war, to preserve the rights and liberties for which the founders of the society had fought, to promote national honor and union among the states, and to render assistance to those officers and their families unfortunately in need of receiving it. The original members each contributed one month's pay, according to their respective ranks, to form a fund for the relief of needy members and their families. At the time this form of relief constituted the only kind of pension given in the country, as federal pensions were not provided until many years later.

The society was named by its founders for the illustrious Roman general, Lucius Quinctius Cincinnatus, who led his army to victory and then returned to his plow, refusing all honors which the Roman senators sought to bestow upon him. This example the founders of the society followed at the conclusion of the war in returning to their respective occupations.

Organization.—The society was originally divided into and now consists of thirteen state societies—corresponding to the thirteen original states—of which those in Massachusetts, New York, New Jersey, Pennsylvania, Maryland, and South Carolina have preserved an unbroken existence. There was also a society in France. There were in all 2,431 original members of the society, including 2,029 in America, 356 in France, and 46 other general officers and officers of various corps and Canadian regiments.

Among the well known foreign members were the Marquis Marie de Lafayette, Baron Friedrich von Steuben, Comte Francois de Grasse, Johann Kalb (Baron de Kalb), Comte de Rochambeau, and Major Pierre Charles L'Enfant, the French military engineer who planned and laid out the city of Washington.

Among the founders of the Society of the Cincinnati, in addition to George Washington, were the following: Horatio Gates, first vice president general; Henry Knox, first secretary general; Alexander McDougall, first treasurer general; John Barry; Nathanael Greene; John Paul Jones; Thaddeus Kosciusko; Henry "Light-Horse Harry" Lee; William Moultrie; Francis Marion; John Peter Mühlenburg; Rufus Putnam; Arthur St. Clair; Philip Schuyler; John Sullivan; and Anthony Wayne.

The founders of the society unanimously elected George Washington as the first president general in 1783, and he continued in that office until his death in 1799. He was succeeded as president general by Alexander Hamilton, elected in 1800, and he in turn by the following: Charles C. Pinckney (1805); Thomas Pinckney (1825); Aaron Ogden (1829); Morgan Lewis (1839); William Popham (1844), who was the last Revolutionary officer to hold this post; Henry A. S. Dearborn (1848); Hamilton Fish (1854); William Wayne (1896); Winslow Warren (1902); John C. Daves (1932); Bryce Metcalf (1939); Isaac Anderson Pennypacker (1950); Edgar E. Hume (1950); and Richard H. Wilmer (1953).

Under a resolution adopted in 1950, presidents general and vice presidents general may not now hold office for more than one consecutive term of three years.

Membership Requirements.—For the purpose of perpetuating the existence of the society, the founders provided in the Institution that the right to membership should descend to their eldest male descendants or, in the event of the failure thereof, to those members of collateral branches of their families who should be judged most worthy of membership. This hereditary right of succession to membership, and the fear that the society might thus establish an organization of hereditary patricians or nobility, created an intense public opposition which continued for some years after the society was organized.

To quiet this opposition, Washington recommended the abandonment of the hereditary right to membership and, although this recommendation was adopted at a general meeting of the society in 1784, the resolution was not ratified by all of the fourteen constituent societies and the hereditary right of succession to membership continued unchanged. In 1953 the total number of hereditary members was 1,705.

In 1854 the society adopted a resolution, known as the "Rule of 1854," under which the eldest male descendant of any Revolutionary officer is generally eligible to membership, even though

his ancestor was not an original member of the society. Although the rules and regulations as to eligibility for membership vary somewhat in the fourteen constituent societies, the Rule of 1854 is observed and followed in all of them with the exception of the Pennsylvania society, which continues in its strict adherence to the original requirements set forth in the Institution.

Insignia.—The order of the society, or badge of membership, which is generally referred to as the Eagle of the Society, was designed by Maj. Pierre L'Enfant, one of the original members. An Eagle set in diamonds was presented to Washington by officers of the French Navy, and this diamond Eagle has been handed down since then to each succeeding president general and is worn by him on formal occasions as his badge of office.

L'Enfant also designed a diploma, or certificate of membership. The original copperplate, now in the Library of Congress, is still in use.

French Society.—Leaders of the French Army and Navy were among the founders of the Society of the Cincinnati in France. King Louis XVI granted them the right to wear the Eagle of the society, although at that time no foreign orders were permitted in France. The Comte d'Estaing and the Comte de Rochambeau were respectively the first president and vice president of the French Society of the Cincinnati. Many of the early members of this branch, including d'Estaing, perished on the guillotine during the French Revolution.

Headquarters.—The headquarters of the society are at 2118 Massachusetts Avenue, N. W., Washington, D.C. This property was the former residence of Captain Larz Anderson, a member of the society, and after his death it was presented to the society for a headquarters and museum in 1937 by his widow. The museum contains many items of historical interest, and is open to the public daily except Sundays and holidays without charge.

CINCINNATI, University of, was the first university in the United States to be municipally supported, its status as a municipal institution having been established by the Ohio general assembly in 1870. The beginnings of the university date back to 1819 when Cincinnati College and the Medical College of Ohio were founded. The latter became the University College of Medicine in 1896. The Cincinnati Law School, founded in 1833, became the University College of Law in 1918. The medical and law units of the university were each the first institutions of their type to be established west of the Alleghenies.

In 1858 the \$500,000 bequest of Charles McMicken to the city for a free university led to the establishment of the McMicken College of Liberal Arts. Other units of the university with dates of their establishment are as follows: College of Engineering (1900); Teachers College (1905); Graduate School of Arts and Sciences (1906); College of Business Administration (1912); College of Nursing and Health (1917); College of Applied Arts (1922); College of Home Economics (1924); Evening classes in the commerce and liberal arts divisions of the university were begun in 1912, and the Evening College was established in 1938. The Research Foundation was organized in 1943.

Closely affiliated with the university are Hebrew Union College, the Cincinnati Conservatory, Cincinnati College of Music, Cincinnati College

of Pharmacy, the Astronomical School, and Cincinnati Observatory. Cleveland Abbe, who became director of the observatory in 1868, inaugurated a daily system of weather reports from which developed the United States Weather Bureau.

The cooperative system of technological education was started at the university by Hermann Schneider in 1906. Under this arrangement classroom work is supplemented by practical experience and training in shops and manufacturing establishments.

In 1953 the university library had 661,527 volumes. Students are also able to use special libraries of other institutions in the city. The university faculty in 1952-1953 had 383 members. The institution is co-educational, and 15,204 students were registered for courses during the above designated academic year. At the same period the value of the physical plant was assessed at \$17,360,206 and the total endowment was \$11,854,180.

CINCINNATI SYMPHONY ORCHESTRA, founded in 1895 under the auspices of the Cincinnati Orchestra Association, and supported by stockholders and subscribers to a guarantee fund. In its first season the orchestra was conducted by Frank van der Stucken, Anton Seidl, and Henry Schrädick. For the second season van der Stucken was made sole conductor, and he remained until the spring of 1907 when the orchestra was temporarily disbanded because of the demands of the American Federation of Musicians.

The orchestra was reorganized in 1909 with Leopold Stokowski as conductor. In the fall of 1912 Ernst Kunwald succeeded Stokowski and continued until December 1917, when he was interned by the government as an enemy alien. For the balance of the 1917-1918 season the orchestra was led by guest conductors, and in 1918 Eugène Ysaÿe became permanent conductor. He was followed in 1922 by Fritz Reiner who continued until 1931, when Eugene Goossens was appointed to succeed him. Goossens conducted the orchestra until 1947 at which time Thor Johnson became conductor.

The presidents of the original association were Mrs. William Howard Taft (1895-1900), Mrs. Christian R. Holmes (1900-1913), and Mrs. Christian Phelps Taft (1913-1929). A financial crisis in 1929 necessitated reorganization, and the orchestra was incorporated under the auspices of the Cincinnati Institute of Fine Arts.

Besides its regular series of concerts the orchestra gives junior high school concerts, young people's concerts, "pop" concerts, and a number of concerts out of town.

CINCINNATIAN, *sin-si-nāt'i-ăn*, in geology the uppermost series of the Ordovician system in North America, formed during an epoch of 10 to 20 million years about 300 million years ago. The principal deposits in the East were eroded from rising land in western New England during the process of mountain making which culminated in the Taconic Orogeny at the close of the period. In central Pennsylvania 2,500 feet have stream-laid red sandstone at the top. Cincinnati rocks of the Arctic regions and western interior are limestones of a few hundred feet. The series is exposed typically in Ohio along the Cincinnati anticline, a broad rock fold from

central Tennessee to southern Georgian Bay, Ontario, formed in later geologic time. See also ORDOVICIAN.

CINCINNATUS, sîn-sî-nā'tūs, **Lucius Quinctius**, a patrician belonging to the earliest period of the Roman republic: b. about 519 B.C. The legend which has enshrined him as a model of Roman virtue is as follows: The Romans of his day were weakened by dissensions between the patricians and plebeians; the warlike Aequians, after making harassing incursions into their territory, succeeded at last in surrounding the Roman army under the consul Minucius in the wooded grounds of Mount Algidus. In despair the Roman senators went to Cincinnatus, offering him the dictatorship. The messengers found him at the plow. Reluctantly he accepted the office. He succeeded in rescuing the army from its perilous position, and marched to Rome laden with the spoils of victory. He refused all honors and returned to his farm, whence he was again called, at the age of 80, to resume the dictatorship, to oppose the machinations of Spurius Maelius, and prevent a civil war between the upper and lower classes, which he succeeded in doing.

CINCIUS ALIMENTUS, sîn'shî-ūs āl-ī-mēn'tūs, **Lucius**, Roman historian and statesman: fl. late 3d century B.C. In 210–209 B.C. he was praetor in Sicily, where he was briefly made prisoner by Hannibal during the Second Punic War. He wrote in Greek a history of Rome covering the period from the founding of the city, which he set at 729–728 B.C., down to his own day. This work, *Annales*, with the work of Quintus Fabius Pictor, whom he followed, formed the basis of the historical tradition which was established to interpret Roman institutions and policies to the Greek world.

CINCO SALTOS, sîng'kō sāl'tōs, town, Argentina, in northern Río Negro territory. It is on a railroad 30 miles west-northwest of Fuerte General Roca, and in an irrigated area on the Neuquén River. It is surrounded by farming country. There are sand and gypsum quarries, and lumbering and wine making are important activities. Pop. (1947 est.) 2,500.

CINCTURE, sîngk'tūr, a type of belt or girdle, which is a feature of practically every type of religious dress. In monastic orders, the cincture is a plain cord, a narrow band of cloth, or a leather belt. As a prelatical ornament, it is a broad strip of some fine material in black or other appropriate color and is adorned with fringe or tassels. For liturgical purposes, the cincture is generally a white cord used for drawing in the flowing folds of the alb.

There is some reason to believe that a girdle of this type was used in the Celtic church. Cinctures which are not Celtic survive from the 10th and 11th centuries. These are of rich material and are covered with much embroidery. Simpler types did not come into general use until late in the medieval period. The type of cincture, or sash, used in the civil dress of some church officials has been adapted for the use of choirboys and acolytes. Used thus, it has not the religious significance usually associated with it. Certain religious orders have special blessings for the cincture.

CINDERELLA, sîn-dēr-ēl'ā, heroine of an ancient tale, analogues of which exist in folk literatures throughout the world. The earliest known version dates from the 9th century A.D. in China.

The story in its best-known form tells of Cinderella, the household drudge, helping her sharp-tongued and ugly stepmother and two stepsisters dress for a ball at the palace. She patiently endures their taunts about not being able to go herself, but after they have left she sits sobbing by the fireplace in the kitchen. At this point her fairy godmother appears. She magically transforms Cinderella into a princess, a pumpkin into a golden coach, mice into horses, and sends Cinderella off to the ball. The only stipulation is that she must leave by midnight when the magic will wear off and everything turn back to what it was. The prince dances with Cinderella and falls in love with her. Unaware of passing time, Cinderella has to dash from the palace as midnight strikes. In her flight she loses one glass slipper. This the prince retrieves, swearing to search the kingdom until he finds the owner. Eventually his travels lead him to Cinderella, now back in her kitchen. To the anguish of the stepmother and the stepsisters who have tried to squeeze their feet into the tiny slipper, Cinderella slips it easily on to her foot. The prince then claims her as his bride and carries her away to become his princess.

This is the story as it appeared in a collection of fairy tales published in France in 1697. The book, known as *Histoires et Contes du Temps Passé*, bore on its frontispiece the inscription *Contes de Ma Mère l'Oye* (Mother Goose's Tales). Among other stories in this book are *The Sleeping Beauty*, *Red Riding Hood*, and *Bluebeard*. Charles Perrault (1628–1703) was responsible for the original collection which was translated into English by Robert Samber about 1729.

Perrault's version of Cinderella contains certain features not found in older versions of the story and omits elements found in other versions. In many of the latter Cinderella is helped by her dead mother who often appears as a cow, goat, or some other domesticated animal. In some renditions Cinderella goes to church or to a festival rather than to a ball. The midnight hour is Perrault's and so is the glass slipper. The Chinese version uses a golden slipper, and some tales of similar type use a ring.

The story has furnished outlines and plots for numerous ballets and operas. *Cendrillon*, a three-act comic opera with libretto and music respectively by the Frenchmen Charles Guillaume Étienne (1777–1845) and Nicolas Isouard (Nicolo) (1775–1818) was presented first in Paris on Feb. 22, 1810. The success of this work led to the appearance of several imitations.

Gioacchino Rossini's opera, *La Cenerentola*, first produced in Rome in 1817, was without a fairy godmother or any other supernatural element. Rossini had stipulated to his librettist, Jacopo Feretti, that these features be omitted. This was chiefly because the Italian stage of the period was not equipped for handling unusual effects. An operatic version much more faithful to Perrault's form of the story was *Cendrillon*, first produced in Paris on May 24, 1899, with a libretto by Henri Cain (1859–1937) and music by Jules Massenet.

An early ballet version was *Cendrillon* (1823)

by the French dancer Ferdinand-Albert Decombe (Albert) (1789–1865). Another ballet, *Cinderella* (1893), was the result of collaboration between the French dancer and choreographer, Marius Petipa (1822–1910), the Italian, Enrico Cecchetti (1850–1927), and the Russian, Lev Ivanov. Michel Fokine (1880–1942) choreographed a *Cinderella* ballet for the Original Ballet Russe in 1938. Sergei Prokoviev (1891–1953) composed the score for a *Cinderella* ballet first danced in Russia by Galina Ulanova. The English dancer and choreographer, Frederick Ashton (1906–), used the Prokoviev score for the Sadler's Wells Ballet's *Cinderella*, in which Margot Fonteyn and Moira Shearer have both danced. The first performance of this ballet was at Covent Garden, London, on Dec. 23, 1948.

CINEAS, sin'ê-ās, Thessalian politician of the late 4th and early 3d centuries B.C. He was a minister of King Pyrrhus of Epirus and warned Pyrrhus of the difficulties in attempting to win a decisive victory over the Romans. After the Romans had been defeated by Pyrrhus at Heraclea in 280 B.C., Cineas attempted without success to negotiate peace terms.

CINEMA, sin'ê-mā (Gr. *kinēma*, motion), shortened form of *cinematograph*. Both words are used in Europe to refer to moving pictures (q.v.).

CINEMASCOPE was first publicly demonstrated in the United States in the autumn of 1953. It was the third in a series of technical innovations brought forth by the motion picture industry in its efforts to win back some of the audience it had lost since the expansion of the television industry.

The word CinemaScope is the trade name for a revised photographic process first demonstrated and theatrically presented in New York City as early as 1930. It involves a method of distortion photography using a cylindrical lens component which compresses a wide scene into a narrow image. The distortion in pictures taken in this way is corrected by a projector equipped with a compensating lens which expands the images to normal proportions when they are thrown onto a slightly concave screen measuring 68 by 24 feet. A slight illusion of depth is created and the general range of vision approximates that of the human eye.

The result is less remarkable optically than Cinerama, but it is nevertheless impressive and avoids some of the difficulties of "three-eyed" Cinerama. Among the cinema techniques newly presented to the public in the early 1950's, CinemaScope has the advantage of using a single standard 35-mm. film. Theater projection equipment already in use is easily adapted for CinemaScope with a few attachments. But the new screen dimensions have introduced architectural problems for many theaters with long, narrow auditoriums. For some of them CinemaScope would be reduced to what is called a "mailslot view." This is because the delivered CinemaScope image requires a screen ratio which, after some fluctuation, has become fixed at 2.55 in width to 1 in height, compared with the 1.33 to 1 of standard pictures.

CinemaScope was the result of observations made in Europe by Earl I. Sponable, chief of technology for 20th Century-Fox. The invention is, for all its tangled history, credited to Henri

Chrétien of Paris, a French optical scientist. Spyros Skouras, president of 20th Century-Fox, interested in the possibilities of these anamorphic—or form-changing—lenses, brought all the resources of his organization to bear on the problem of developing the technique for commercial use.

The first experimental lenses arrived in Hollywood in January 1953, and the first public appearance of CinemaScope in the United States was the premiere of *The Robe* at the Roxy Theatre, New York City, on Sept. 16, 1953. The film was derived from the ten-year-old best-selling novel of the same name. The lay press generally acclaimed *The Robe* and the public was enthusiastic. The role of CinemaScope in this success was important. 20th Century-Fox announced that all its future productions would be filmed with the new lenses and other film companies began exploratory work under CinemaScope license. By the end of 1953, 200 theaters in the United States were equipped to exhibit CinemaScope motion pictures. By mid-summer of 1954 it was claimed that a total of 6,000 were in operation, nearly all of which were in the United States.

TERRY RAMSAYE.

CINERAMA is based on the principle of peripheral vision, bringing to the eye the sensations at the periphery of normal sight. The object fills the eye. One is aware not only of what is in front, but also of what is on both sides as far as the vision can reach. This gives the viewer an illusion of depth and makes the picture seem to have no limitation, no frame. The spectator seems to be in it; instead of merely looking at a picture, he has the impression of being himself a part of the scene. Someone has said that standard motion pictures are like looking into a room through a keyhole, while Cinerama is like being in the room.

Much of the dynamic effect of motion is derived from what one sees out of the corner of the eye. This is illustrated by the way a person will shy away from something coming from the side, glimpsed out of the corner of the eye. That is why the sensation of motion can be so vivid in Cinerama.

The pictures are taken with three synchronized cameras, on three separate films. These in turn are projected by three machines onto a deeply curved screen made of perpendicular strips of material. The curvature of the screen is basic for the optical effect produced. The arc of the screen and the optical focus are such as to heighten the effect of peripheral vision.

Cinerama was devised by Fred Waller, a veteran of motion picture technology. Beguiled by the problem of peripheral vision on the screen, he experimented for years, and made his first important demonstration at the New York World's Fair in 1939. During World War II the United States government became interested in his experiments and backed him in the development of a special gunnery trainer for airmen, using a circular screen that went all the way around a large room with one continuous motion picture, projected by eleven machines. Later on, Waller continued his experiments at the John D. Rockefeller home in New York City with funds provided by Lawrence Rockefeller and the backers of *Time* and *Life*. But at that stage neither the inventor nor those who financed him believed they had anything ready for the public.

Subsequently Hazard Reeves, the sound tech-

nician, became interested. From the Reeves laboratory came the stereophonic sound, which is all-important for Cinerama. Hazard Reeves in turn introduced Lowell Thomas, radio and film commentator, and producer of documentary films, to Cinerama. He soon interested Merian C. Cooper, top ranking film producer of Hollywood, and together Thomas and Cooper produced the first picture *This Is Cinerama*. The success was phenomenal, first in New York (Sept. 30, 1952), then Detroit, Los Angeles, and Chicago. People came from all over the world to see this new marvel of the entertainment world, with its principle of peripheral vision creating an illusion that viewers agree exceeds reality. In any real-life scene in daylight a diffused light fills the atmosphere; but when one looks at Cinerama, one is in a darkened theater—hence the effect of viewing a glowing scene in all its brilliant colors, at night. This is what makes Cinerama seem more real even than reality.

CINERARIA, a group of plants of the Compositae family, which appear to be various hybrids of *Senecio Cineraria*, a native of the Mediterranean region, and *S. cruentus*, from the Canary Islands. They have large hairy leaves and dense clusters of white, blue, pink or reddish flowers. They are extensively grown by florists as pot-plants, and by careful breeding a large number of varieties of various color and size have been obtained. Their long culture and breeding have resulted in a distinct group which might be called "florists' Cineraria."

For culture consult Bailey, L. H., *The Standard Encyclopedia of Horticulture*, vol. 1, pp. 771, 772 (New York 1939).

CINEY, sē-nā', town, Belgium, in Namur Province, in the southern part of the country, nine miles east-northeast of Dinant. It is a rail junction, and has an important horse market and metals industry. The town has been a market center since the 16th century. It is in the center of the Condruz district, ancient home of the German tribe, the Condrusi. Pop. (1948) 6,106.

CINGOLI, chēng'gō-lē (ancient CINGULUM), commune, Italy, located in Macerata Province in the central part of the country in the Marche region. It is near the Musone River, and is 17 miles by road west-northwest of Macerata. There are textile mills and a macaroni factory.

Cingoli is referred to by Julius Caesar in his *De bello civili* as having been founded by one of his lieutenants, Titus Labienus, in 63 B.C. Situated at an altitude of 2,300 feet, it was a strategically important point during the Roman civil wars. The town was nearly destroyed during the invasions of the Goths and Lombards. Some remains of the ancient walls still stand, and there is also a Gothic church which was rebuilt in 1278. Pop. (1951) 15,774.

CINI, chē'nē, Giovanni, Italian sculptor: d. about 1565. Most of his life was spent in Poland, where he went in 1507 at the call of Francesco Lori, architect to Sigismund I, king of Poland. Cini's chief work, undertaken with other artists, was the decoration of Sigismund's chapel in Krakow, richly sculptured and ornamented.

CINISELLO BALSAMO, chē-nē-zē'lō bāl'sē-mō, commune, Italy, in Milano Province,

Lombardy Region, of northern Italy. It is seven miles north of the city of Milan. It has a foundry and macaroni and soap factories. Pop. (1951) 15,265.

CINISI, chē'nē-zē, commune, Sicily, in Palermo Province, 14 miles west-northwest of the city of Palermo. It is in a cereal grain and grape-growing area, and has an ancient castle. Pop. (1951) 7,581.

CINNA, sīn'ā, Gaius Helvius, Roman poet of the 1st century B.C. He was a friend of the poet Catullus with whom he went to Bithynia on the staff of the governor, Memmius, in 57 B.C. Most of his poetry, fashioned on Alexandrian models and extremely obscure and erudite, has been lost. The *Zmyrna*, or *Smyrna*, which survives in fragments, deals with the incestuous love of a girl for her father.

It has been generally accepted, though there is some doubt, that this was the Cinna killed by the mob at the funeral of Julius Caesar in 44 B.C. Shakespeare, following Plutarch, depicts the lynching of Cinna in *Julius Caesar*. Despite his protestations that he is "Cinna the poet" he is taken to be Lucius Cornelius Cinna, the younger, who had expressed approval of Caesar's murder.

CINNA, sīn'ā, Lucius Cornelius, Roman patrician, associate of Marius and leader of the popular party, during the absence of Sulla in the East. In 86 B.C. he was elected consul along with Octavius, and in violation of his oath to Sulla he attempted to overpower the Senate and to procure the recall of Marius and his party from banishment. In the contest which ensued he was defeated by his colleague and driven from the city. His office thus became vacant, and the Senate appointed another consul in his stead. He soon returned, however, along with Marius, and laid siege to Rome. The Senate was forced to capitulate; but while the votes of the people were being taken for the repeal of the sentence against Marius, Cinna broke into the city, massacred the friends of Sulla and allowed his partisans to commit frightful excesses. He was consul for the next three years; but Sulla, having brought the Mithridatic War to a close, resolved (84 B.C.) to return to Italy to inflict condign punishment on his enemies. As Cinna was preparing to resist him by force of arms, he was slain by mutineers among his own troops.

His daughter CORNELIA became the first wife of Julius Caesar in 83 B.C. She died about 67 B.C.

His son LUCIUS CORNELIUS was praetor in 44 B.C. He was involved in the plot to assassinate Julius Caesar in 44 B.C.

CINNABAR, sīn'ā-bār, red sulphide of mercury, HgS. The native cinnabar occurs in earthy, granular and massive forms, and also in crystals belonging to the rhombohedral system. It is red, not infrequently with a brownish or leaden cast. Its hardness is from 2 to 2.5 and its specific gravity from 8 to 8.2. Artificial cinnabar, formed by subliming a mixture of sulphur and mercury, is brighter in color than the native mineral, probably on account of its greater purity, and is known in commerce as "vermilion." Cinnabar is the principal ore of mercury, and large deposits of it occur at Almaden, Spain, at Idria in Carniola, at New Almaden, Cal., and in certain parts of China and Japan. When it is roasted the sul-

phur burns away and metallic mercury distills off and is condensed in earthenware vessels.

CINNAMIC ACID, *sī-nām'ík*, an acid which exists in the free state in the balsams of Tolu and Peru, in liquid storax and in gum benzoin. It occurs in two forms, slender needle-like crystals, and large transparent prisms, melting at 270°F. When oil of cinnamon is exposed to the air it absorbs oxygen and deposits crystals of cinnamic acid, which are colorless and readily soluble in alcohol, ether and boiling water, but sparingly soluble in cold water. It is not of any importance in the arts and is chiefly interesting as being the acid corresponding to oil of cinnamon. This oil is the aldehyde of cinnamic acid and is represented by the formula $C_9H_8O_2$. Though isomeric with oil of cassia it has a slightly different flavor, and is much more expensive. Both of these oils are employed in medicine as aromatic stimulants, but chiefly as pleasant adjuncts to disguise the taste of nauseous drugs. From a chemical point of view, the cinnamic acid and oil of cinnamon are related to benzoic acid and oil of bitter almonds. Oxidizing agents convert it first into benzaldehyde and then into benzoic acid. It unites with hydrogen to form hydrocinnamic acid.

CINNAMOMUM. See CASSIA; CINNAMON; LAUREL.

CINNAMON, the bark of the under branches of a species of laurel (*Cinnamomum zeylanicum*), which is chiefly found in Ceylon, but grows also in Malabar and other parts of the East Indies. The tree attains a height of 20 or 30 feet. Its leaves are oval, the flowers are of a pale yellow color and the fruit is shaped somewhat like an acorn. There are two principal seasons of the year in which the Ceylonese bark the cinnamon trees. The first of these commences in April, and the last in November; the former being that in which the great crop is obtained. In this operation the branches of three years' growth are cut down, and the outside pellicle of the bark is scraped away. The twigs are then ripped up lengthwise with a knife and the bark is gradually loosened till it can be entirely taken off. It is then cut into slices and on being exposed to the sun curls up in drying. The smaller pieces, or "quills," as they are called, are inserted into the larger ones, and these are afterward tied into bundles. From the roots of the trees numerous offsets shoot up. These, when they have attained the height of about 10 feet, are cut down and barked, being then about the thickness of a common walking-stick. The cinnamon which they yield is much finer than any other. In Ceylon the cinnamon trees are said to be so common as to be used for fuel and other domestic purposes. The smell of cinnamon, particularly of the thinnest pieces, is delightfully fragrant, and its taste pungent and aromatic, with considerable sweetness and astringency. If infused in boiling water in a covered vessel it gives out much of its grateful flavor and forms an agreeable liquid. An oil is extracted from cinnamon, which is heavier than water. This is prepared in Ceylon, and almost wholly from the small and broken pieces. It is made, however, in such small quantities that the oil of cassia is generally substituted for it; indeed, the cassia bark is often substituted for cinnamon, to which it has some resem-

blance, although in its qualities it is much weaker. The leaves, the fruit and the root of the cinnamon plant all yield oil of considerable value. That from the fruit is highly fragrant, of thick consistency, and in Ceylon was formerly made into candles for the sole use of the king.

The oil of cinnamon consists mainly of cinnamic aldehyde, C_9H_8O , which, when pure, is colorless. By exposure to the air it absorbs oxygen and is converted into cinnamic acid (q.v.).

Various forms of cinnamon have been used for many years in medicine as flavoring agents and as carminatives. As cinnamon is rich in volatile oils, the action of the drug resembles the action of the oil of cinnamon, which is closely allied to other volatile oils (q.v.). The active principle in the oil is an aldehyde of cinnamic acid, and its antiseptic and antispasmodic action is due in large part to the cinnamic aldehyde.

CINO DA PISTOIA, *ché'nò dā pēs-tō'-yā*, Italian poet and jurisconsult: b. Pistoia 1270?; d. there, 1336 or 1337. He received the doctor's degree from the celebrated law school of Bologna, and from 1321 to 1333 taught law at the universities of Siena, Perugia, and Naples. Cino ranks among the best lyric poets of early Italian literature and both Dante and Petrarch seem to have greatly admired his poems. About 200 sonnets and *canzoni* have been preserved, most of them dealing with his unhappy love for a lady of Pistoia; they all show a musical sense of rhythm and a vivid imagination in expressing love, sorrow, anxiety, and the fear of death. One of the editions of his poems was prepared by Giosuè Carducci (Florence 1862 and 1864). Cino's most important juridical work is *Lectura in Codicem*, a commentary on the first nine books of Justinian's code.

CINQ-MARS, *sān-mār'*, MARQUIS DE (HENRI COIFFIER DE RUZÉ), French courtier: b. 1620; d. Lyon, Sept. 12, 1642. At the age of 18 he was presented at court by Cardinal de Richelieu and soon obtained the favor of Louis XIII, to whom he became master of the horse. Chafing at the restraint under which Richelieu held him and ambitious of political power, he framed a conspiracy to overthrow the cardinal, of which the king himself and his brother, Gaston, Duc d'Orléans, were members. But Louis was weak and fickle, Gaston perfidious and Richelieu not the man to be put down by a youth just turned 20. Cinq-Mars was delivered up to the cardinal and beheaded at Lyon with his friend, the councillor de Thou. The conspiracy of Cinq-Mars is the basis for a novel by Alfred de Vigny entitled *Cinq-Mars* (q.v.).

CINQ-MARS, by Alfred de Vigny, is one of the most popular French historic novels. Published in 1826, it showed unmistakable traces of the influence of Sir Walter Scott and was an immediate success. The novel deals with that important and interesting period of French history which culminated in the sway of Cardinal Richelieu, the minister of Louis XIII. It is Richelieu, more than the favorite of the king, Cinq-Mars, who is the central figure of the story. The author does not keep very strictly to the historic facts and misrepresents to a great extent the characters which he portrays. For de Vigny, Richelieu is a symbol of ambition, while de Thou, the devoted follower of Cinq-Mars, is the type of the friend. Even the minor characters of the book

CINQUE PORTS—CINTRA

are treated according to the preconceived idea of the author. The novel is thus a curious mixture of history and fiction. But in spite of the falseness of the historic treatment there is much in the novel which explains and in a way justifies its wide popularity. There was a great revival of interest in the past at the time the book was written, and no other period, perhaps, was so full of dramatic incidents and gave such opportunities for character study as that of the administration of Richelieu. Again, the lyric note of the novel is admirable. The picture in the opening chapter of beautiful and peaceful Touraine, where the author himself was born and which he knew well and loved, together with passages of similar charm and beauty, such as the description of the château of Chambord, are veritable poetic gems—and, after all, was not Alfred de Vigny primarily a poet? The reader will gladly overlook the historical inaccuracies, which were intentional, and will forgive the rather poor psychology of the characters for the sake of the spirited and entertaining story and the passages of exquisite description.

RAYMOND WEEKS,
Formerly Professor of Romance Languages and Literatures, Columbia University.

CINQUE PORTS, singk pōrts, a group of towns, originally five in number (hence the name), situated on the southeast coast of England, in the counties of Kent and Sussex. From the original five towns (Hastings, Romney, Hythe, Dover, Sandwich), which were associated to provide the crown with ships to patrol the straits, the association grew to include, at one time, over 30 ports, two of which, Winchelsea and Rye, were considered, with the original five, as head ports. The remaining members, whether corporate or non-corporate towns, were given the title of "limb" or member and held a subordinate position. The association's jurisdiction extended along the coast from Seaford in Sussex to Birchington, near Margate, in Kent, and included a number of inland districts at a considerable distance from the ports with which they were connected.

The incorporation of the Cinque Ports arose from their strategic position in relation to the Continent and the necessity of defending the southern seaboard in days before the existence of the Royal Navy. The oldest charter of the organization now extant is one which dates from the sixth year of Edward I (1278) but it refers to previous documents of the times of Edward the Confessor (r. 1042–1066) and William the Conqueror (r. 1066–1087), showing that the association is much older. The actual date of its foundation is obscure, but it may even ascend to the counts of the Saxon shore in the 4th century. The decline of the Cinque Ports began with the creation of the Royal Navy in Tudor times, and their charters were surrendered to the crown in 1685. Most of their peculiar privileges and obligations were abolished by the Reform Act (1832) and the Municipal Corporations Act (1835). The Warden's Court, however, still exercises an Admiralty jurisdiction, which was specially reserved to it when its civil jurisdiction was abolished in 1869.

The privileges enjoyed by the towns included exemption from all taxes, aids, and tallages; the right of civil and criminal jurisdiction within their limits; the right of assembling in their own port-moot, or parliament, at Shepway, near

Hythe, for the purpose of making bylaws; and several other privileges, including the right of regulating the Yarmouth fishery and fair. In return the ports were to furnish the crown with 57 ships for 15 days each year, and there is one instance on record where they had to furnish supplies for the ships provided by London.

The officer in command of the ships furnished by the Cinque Ports was the lord warden. Since 1700 the office has been held by such personages as Prince George of Denmark (husband of Queen Anne), the duke of Wellington, Viscount Palmerston, the 3d marquess of Salisbury, King George V (when prince of Wales) and Sir Winston Churchill, who became lord warden in 1941. The lord warden is concurrently constable of Dover Castle and until 1903 had another official residence at Walmer Castle. The present emoluments of the office are insignificant and the duties are negligible.

With the exception of Dover, the towns are now important only as seaside resorts. Changes in the coastline have necessitated expensive harbor works, and two of the head ports, Winchelsea and Rye, now lie inland, while Romney and Hythe have been forced partially to rebuild. The populations of the seven head ports are (1951 census) Hastings, 65,506; Romney (New Romney), 2,356; Hythe, 9,218; Dover, 35,217; Sandwich, 4,142; Winchelsea (est.), 130; and Rye, 4,511.

Consult Burrows, Montagu, *Cinque Ports* (London 1888); Bosworth, G. F., *Kent* (Cambridge, England, 1909); Murray, K. M. E., *Constitutional History of the Cinque Ports* (London 1935); Church, Richard, *Kent* (London 1948).

RICHARD WEBB,
British Information Service, New York.

CINQUECENTO, ching-kwê-chên'tō, in Italian, 500, an abbreviation for *mille cinquecento*, or 1,500. The term designates such art and literary styles of the 16th century as were developed about, or after, 1500. In like manner the terms *trecento* and *quattrocento* denote art and literature of the 14th and the 15th centuries. The cinquecento is the period of the highest perfection of the arts of the Revival or Renaissance.

CINQUEFOIL, singk'foil. (1) *In botany*, a species of the genus *Potentilla* of the rose family, closely allied to the strawberry. Of the approximately 300 species in the north temperate zone, 175 occur in North America, scattered throughout the continent. The name is from *cinque* (five) plus *foil* (Fr. *feuille*, leaf) referring to the five leaflets in many of the species. In northern New England the shrubby or bush cinquefoil (*P. fruticosa*) is a troublesome weed. This is sometimes called hardhack, but the true hardhack is *Spiraea tomentosa*. *Potentilla* is from Latin *potens* (powerful), from the supposed powerful medicinal virtues of some of the species.

(2) *In architecture*, it is an ornament in the Gothic style, consisting of five foliated divisions, often seen in circular windows.

(3) *In heraldry*, it means a five-petalled corolla borne without a stalk and set fullfaced, used as an emblem in a coat of arms.

CINQUEPACE, sing-kê-pās', a kind of stately dance of the 16th century, in which steps were regulated by the number five.

CINTRA, town, Portugal. See **SINTRA**.

CIOTAT, La. See LA CIOTAT.

CIPHER, sî'fēr, a kind of monogram, in which the initials of a person or persons are intertwined.

CIPHER AND CODE WRITING, the art of concealing the true meaning of a message from any but the intended recipient. It is a branch of cryptography (q.v.). As soon as literacy became reasonably widespread, soldiers, diplomats, and, probably, criminals, wishing to communicate privately with one another, began to devise methods of secret writing.

Methods.—One fairly obvious method is to use a language (either real or invented for the occasion) which is unlikely to be known to anyone except the person for whom the message is intended. A secret language of this kind is called a code.

Another method, known to have been used by the Spartans as early as 404 B.C., is to scramble the letters of the original or "clear" message by a scheme known to the recipient, who then can rearrange the apparent jumble of letters to reveal the sense. This is known as a transposition cipher. The method used by the Spartans was to wind a belt spirally round a thick wooden rod and to write the "clear" on it, so that when the belt was unwound it seemed to be covered with meaningless letters. (As belts so decorated were commonly worn at that time, no suspicion would be aroused.) The recipient wound the belt on another rod of the same diameter as that used by the sender and read the message.

The third basic method is to use a private alphabet, in which the letters of the original "clear" are replaced by other letters or by specially invented symbols. This is a substitution cipher. A simple substitution cipher is the Julian, reputedly invented about 58 B.C. by Julius Caesar, in which each letter is replaced by the one following it in the alphabet. By this system "HIDE AT ONCE" becomes "IJEF BU PODF." The Morse code, so called, is really a substitution cipher, in which each letter is replaced by an arrangement of dots and dashes, or long and short sounds in actual telegraphy. (See TELEGRAPHY—*Telegraph Alphabets*.)

All known methods of preventing an unauthorized reader from solving the true meaning of a message are developments or combinations of the code, the transposition cipher, or the substitution cipher. The last 2,000 years have produced no fundamentally new technique.

Codes.—For most of this period codes underwent no major development, being in effect artificial languages of normal construction, in which a word in the code language would correspond directly with a word in some normal tongue, such as French or English. The "thieves' cant" of the Middle Ages and cockney rhyming slang, in which "stairs" became first "apples and pears" and, in the finally developed form of the code, merely "apples," are examples. The invention of the telegraph, with its charges by the word, encouraged the development of codes in which one word or "group" of the code may stand for a complete sentence. A well-known example is the International Code group SOS, meaning "I AM IN DANGER AND REQUIRE IMMEDIATE HELP." This condensation is characteristic of all codes in general use today—both the International and Commercial codes, which are not se-

cret, as anyone can obtain copies of the code books or dictionaries used, and the secret codes used by governments of the world for diplomatic and military communication. Many readers will remember the numeral code used to transmit family messages to servicemen during World War II. A serious disadvantage of the code for many applications is that it is difficult, if not impossible, to learn it by heart, so that a code book—really a dictionary of the code language—must be used. Not only is this usually very bulky, but, if it should fall into the wrong hands, even temporarily, the secrecy of the code is compromised.

Ciphers.—Ciphers, both substitution and transposition, are normally much easier to carry in the head, but are also more easily "broken" or reconstructed from the cipher message by someone not in possession of the key. For this reason they have developed steadily in complexity and difficulty since their introduction, as the result of the continual war between the cipherer and the decipherer.

Transposition.—The transposition cipher is essentially a form of anagram. If the relative frequency of the letters in the message is normal for the language in which it is written, then a transposition cipher almost certainly has been used. The general method of solution is to find the letters in the message that normally come together (as TH, HE, ING, in English) and to try to establish some periodicity in their appearance from which the "mixing up" method may be deduced. A variant of the transposition cipher jumbles complete words instead of letters—a system used by the Union Army in the Civil War. It may be attacked by essentially the same method, usually by bringing together adjectives and nouns (like "prepared" and "positions"), which look as if they may belong with each other.

Apart from the already discussed Spartan system, transposition ciphers may be constructed by writing the "clear" message in horizontal lines each containing an equal number of letters, then by copying the vertical columns or the diagonals, or by following any other trace through the rectangle so formed. By this method the "clear" "HIDE AT ONCE" may be put down as a rectangle

HIDE
ATON
CEXZ

and transmitted as "HACE XZNE DITO" by following an anticlockwise spiral, beginning at the top left-hand corner. The meaningless letters xz, inserted to complete the rectangle, are called "nulls."

It is customary in all cipher work to ignore the divisions between words and to write the message in arbitrary "groups," since the preservation of normal word divisions greatly aids the decipherer.

Another method of producing a form of transposition cipher is the Cardan grill, a sheet of cardboard or similar material with holes cut in it. This is placed on a sheet of paper and the words or letters of the "clear" message written through the holes. The grill is then removed and the rest of the paper is filled with meaningless words or letters. The recipient has an identical grill, lays it on the sheet, and reads the message. Ciphers in which, for example, each second word after a comma must be read to give the true message are based on the same principle. Grill ciphers can be hard to break, but they are

cumbersome to use, and their usefulness is rather limited by the fact that in most cases the actual sheet of paper used by the sender must be transmitted to the receiver.

Substitution.—The simple substitution cipher is practically confined to nonsecret applications, such as the Morse code, a few "secret societies," and children's groups associated with some breakfast cereal. To break such a cipher it is only necessary to prepare a table of the frequency of appearance of the various symbols and to assign to the most frequently appearing symbol the most frequently appearing letter in the language used (e in English), and so on down the line; then, unless it is so short that no reliable frequency table can be constructed, the message falls apart. Worked-through examples of the breaking of a simple substitution cipher will be found in Edgar Allan Poe's *The Gold Bug* (1843), Arthur Conan Doyle's *The Adventure of the Dancing Men* (1903); and in the article CRYPTOGRAPHY in this encyclopedia.

By the 16th century most substitution ciphers had surmounted this difficulty by providing more than one equivalent for the commoner letters, but this simple cipher with suppression of frequencies did not preserve its secrets for long, as groups of symbols differing only slightly may be assumed to represent some common group of letters (such as ENCE), and lists of equivalent symbols may be composed, after which the cipher reverts to a simple substitution.

Most modern substitution ciphers are of the "double substitution" type, in which a different cipher alphabet is used to encipher each successive letter of the clear text. Ciphers of this kind, and the method of their solution, are described in more detail in the article CRYPTOGRAPHY.

Syllabic.—A hybrid between the substitution cipher and the code, not now much used but very popular in the 17th century, is the syllabic cipher, in which each symbol represents a complete syllable. For example if DEM = 57, oc = 38, and RAT = 66, then 57-38-66 is the encipherment of DEMOCRAT. Such a cipher, of course, must be attacked with a relative frequency table for syllables instead of for letters, but apart from this the general method of solution is the same as for any other substitution cipher.

Insolubility.—The question often is asked whether there is such a thing as an insoluble code or cipher. The answer is yes, with reservations. Even the most elementary simple substitution cipher is practically insoluble, if it is used once only in a message so short that no reliable table of letter frequencies can be established and if the would-be solver has no clue as to the wording of the original clear text. Ciphers have been constructed that can be proved mathematically to be insoluble without the key, even if the general method of their formation is known, but they either are unacceptably cumbersome to use or have the fatal practical defect that one mistake in encipherment or transmission makes irretrievable nonsense of the rest. Diplomatic and, to a lesser extent, naval messages, composed and encoded by skilled men in no particular hurry and with all the apparatus (often including mechanical ciphering machines) which they desire at their disposal, written first in code and then ciphered, usually by both substitution and transposition methods, are very close to insolubility, though they have been broken. On the other hand, a signal, in some necessarily fairly simple cipher, radioed back

from a forward observation post by a frightened sentry under heavy attack, seldom will resist skilled analysis for more than a few minutes. If, however, by the time that the signal has been deciphered the information which it contains is of no use to the unauthorized reader, the cipher has served its purpose. A code or cipher is like a safe. No safe or strongbox is absolutely impregnable, but it is designed in ratio to the value of its contents, so that the time and the effort which a burglar would need to "crack" it is, at worst, greater than the contents are worth or, at best, enough to keep him occupied until the police arrive.

There are not many books on the subject generally available in English and fewer still are in print. An excellent summary of the history of codes and ciphers, with very full explanations of their construction and solution, may be found in Fletcher Pratt's *Secret and Urgent* (New York 1942).

PAUL D. HOBSON,
Lieutenant (E) Royal Navy, Retired.

CIPHERS, signs for numbers. They are either borrowed signs, as letters, with which the Greeks and several tribes of northern Europe designate their numbers; or peculiar characters, as the modern or so-called Arabic ones, though the Arabs do not use them and never did. The ciphers now in use—1, 2, 3, 4, 5, 6, 7, 8, 9, and 0—did not attain their present character until about the first half of the 14th century. As early as the 9th century ciphers were used, though not until the 11th century did their use become common in Europe.

CIPPUS, sip'ūs, a low column, generally rectangular, sometimes cylindrical, usually sculptured, and often bearing an inscription, used by the Romans for various purposes. Cippi served as sepulchral monuments, as milestones and boundaries, and in some cases as pillars or posts whereon were inscribed laws and notices. They were frequently or usually adorned with rams' heads supporting festoons of flowers, figures of sphinxes, and various mythological subjects. Those serving as tombstones bore deceased's epitaph, name, and the dates of birth and death.

CIPRIANI, chē-prē-ā'nē, Amilcare, Italian revolutionist: b. Anzio, Italy, in 1845; d. Paris, France, May 2, 1918. An ardent follower of Giuseppe Garibaldi and Giuseppe Mazzini (qq.v.), he fought and worked for Italian independence. At the age of 14 he fought at the Battle of Solferino (1859), went with Garibaldi in 1860-1862 to Sicily, Naples, and Aspromonte; supported Karl Marx in forming the International Workingmen's Association; and was in Paris aiding the Commune at the close of the Franco-Prussian War (1870-1871). For his revolutionary activities in Italy he was sentenced to imprisonment, but the electors of Rimini, Forlì, and Ravenna saved him by electing him 11 times to the Chamber of Deputies. Pardoned in 1888, he lived for a time in France, but returned to Italy in 1891, when he was imprisoned for several years. He was a delegate to the International Socialist Congress in Zurich in 1893. At the outbreak of the Graeco-Turkish War he joined the Greeks and was wounded at the Battle of Domokos (1897). In 1913 he refused to take an oath of loyalty to the king and returned to Paris, where he edited a

Republican-Socialist journal. In World War I he urged Italian participation on the side of the Allies.

CIPRIANI, Giovanni Battista, Italian historical painter: b. Florence, Italy, 1727; d. London, England, Dec. 14, 1785. While living in Rome, he met Sir William Chambers, an English architect, whom he accompanied in 1755 to London, where he made his home. There he managed a school of art and became one of the first members of the Royal Academy in 1768. His drawings were his best work, many of them being engraved by Francesco Bartolozzi. The panels on the state coach used in the coronation procession were painted by him. He was buried in Chelsea, London, where a monument by Bartolozzi was erected to his memory.

CIRCARS, Northern. See **NORTHERN CIRCARS**.

CIRCASSIA, sēr-kāsh'ī-ā, historical area, in the northwest foothills of the Greater Caucasus Mountains, Russian SFSR, administratively divided into two autonomous regions: Adygei in Krasnodar Territory and Cherkess in Stavropol Territory. The Adygei Region has an area of 1,700 square miles, and lies mainly in the valley of the Belaya River, a tributary of the Kuban. Its capital is Maikop, the center of a huge oil field and a city with food-processing and wood-working industries. To the east is the Cherkess Region, with an area of 1,540 square miles. The capital is Cherkessk, which has food-processing industries, but is better known as the northern terminus of the highway across the Greater Caucasus Mountains to Sukhumi on the Black Sea coast. Both regions have a mild, moist climate, and consist geographically of northern lowlands and southern mountains. Grain and sunflowers are the main crops on the lowlands, where there is considerable dairy farming. Livestock raising on mountain pastures is the chief upland occupation, but timber cutting is an important industry. The lowland population is predominantly Russian, with Circassians largely confined to the mountains.

The Circassians (more properly Adygei or Cherkess) follow the Moslem religion and are a Japhetic race related to Georgians and Armenians. They are a sturdy, handsome people, and Circassian men are among the finest equestrians in the world. Before World War I many Circassian women were found in Turkish harems, where they were highly prized for their beauty.

The origins of the Circassians are lost in antiquity. During the Middle Ages they occupied much of the northwest of the Greater Caucasus Mountains, with their capital at the Black Sea port of Sukhumi. From the 10th to the 13th centuries Circassia was under the rule of Georgia. Thereafter the Circassians maintained a precarious independence for several centuries, fighting and occasionally paying tribute to the Crimean Tatars. In the 16th century czarist Russia began to aid Circassia in this struggle. By 1705, the Tatars were finally defeated, after which the Russians themselves began slowly encroaching on Circassian territory. Russia seized all Circassia in 1829, on the legal pretext that it was territory ceded by Turkey as a result of a Russo-Turkish war. Actually Turkey never had ruled Circassia, but had merely maintained a trading station on

the coast. The Circassians rebelled against Russian occupation and fought a valiant, but hopeless, battle for independence until 1864, largely under the leadership of the great Caucasian hero Shaml. Local patriotism was so intense that, when the Russian armies finally won, most Circassians refused to remain in the Caucasus and emigrated to Turkey. Possibly as many as 500,000 thus resettled in Asia Minor, Bulgaria, and Serbia. Much of Circassia was depopulated, later to be settled by other Caucasian races and Russians. The remnants of the proper Circassians living in the USSR (1950) number approximately 93,000 people.

ELLSWORTH RAYMOND,
Professor, Soviet Government and Economics,
New York University.

CIRCE, sūr'sē, in classical mythology, a sorceress on the island of Aea. Odysseus (Ulysses) in his wanderings landed on her island and sent Eurylochus with a party to explore the country. They arrived at the palace of Circe, who gave them food and wine and with her magic wand changed them into swine. Eurylochus only, by abstaining from the magic potion, escaped and informed Odysseus of the event. Proceeding to rescue his men, Odysseus met the god Hermes (Mercury), who gave him moly (a herb) to protect him from enchantment. Following the god's advice, Odysseus ran upon Circe with his drawn sword, threatening her with death, compelling her to deliver his companions and to do them no further harm. After living with her for a year and having a son, Telegonus, by her, on her advice Odysseus summoned the shade of the blind seer Tiresias from Hades, to prophesy as to his fate and to receive instructions for his homeward journey. The story is told in the *Odyssey* (q.v.).

CIRCINUS, sūr'sī-nūs (pair of compasses), one of the 14 southern constellations added to the heavens by Nicolas Louis de Lacaille in his posthumous work which appeared in 1763. In the Milky Way it is surrounded by Apus, Musca, Centaurus, Lupus, Norma, and Triangulum Australe. It is inconspicuous, containing only 14 stars visible to the naked eye, the brightest being of the third magnitude.

CIRCLE, sūr'k'l, in *geometry*, a plane figure contained by one line, which is called the "circumference" and is such that all straight lines drawn from a certain point (the "center") within the figure to the circumference are equal to one another. According to this definition of Euclid, which is remarkable for its perspicuity and precision, the circle is the space enclosed, while the circumference is the line that bounds it. The circumference is, however, frequently called the circle. However, no confusion ever arises from this usage.

The properties of the circle are investigated in books on geometry and trigonometry. Properly the curve belongs to the class of conic sections and is a curve of the second order.

The Cartesian equation of a circle with center at the origin and radius R is $X^2 + Y^2 = R^2$. Its polar equation is $P = r$. The general Cartesian equation of a circle is $x^2 + y^2 + ax + by + c = 0$; the general polar equation is $P \sin(\theta + a) = a + bP^2$. From the standpoint of projective geometry, a circle is any conic passing through a certain pair

of imaginary points at infinity, known as the circular points.

The celebrated problem of "squaring the circle" has given rise to extraordinary geometrical labors, and even now there are to be found, as in the case of the problem of perpetual motion, those who profess to have solved it.

The question is to construct by ruler and compasses a square whose area shall be equal to the area of a circle. It is not possible to do so. This was only shown in 1882 by Ferdinand Lindemann. All that can be done is to express approximately the ratio of the length of the circumference of the circle to the diameter and to deduce the area of the figure from this approximation. This ratio, which is known as π , has, however, been determined to a degree of exactness more than sufficient for all practical purposes. If the diameter be called unity, the length of the circumference of the circle is 3.1415926535...; and the area of the circle is found by multiplying this number by the square of the radius. Thus the area of a circle of 2 feet radius is 3.14159×4 , or 12.56636 square feet, approximately.

π can be approximated by infinite series, or by infinite products, or by continued fractions as follows:

$$\begin{aligned}\pi &= 4\left(1 - \frac{1}{2} + \frac{1}{4} - \frac{1}{8} + \dots\right) && \text{(Leibnitz)} \\ &= 2\left(\frac{2}{1} \cdot \frac{2}{3} \cdot \frac{4}{5} \cdot \frac{4}{7} \cdot \frac{8}{9} \cdot \frac{8}{11} \cdot \dots\right) && \text{(Wallis)} \\ &= \frac{4}{1 + \frac{1}{2 + \frac{9}{2 + 25} \dots}} && \text{(Brouncker)}\end{aligned}$$

For trigonometrical calculations the whole circumference of the circle is divided into 360 equal parts or arcs, called degrees; each degree is divided into 60 minutes, and each minute into 60 seconds. The angles subtended at the center by these arcs are called respectively degrees, minutes, and seconds of angle. A centesimal system of circular division is sometimes used. For purposes of pure mathematics the unit is the radian, that is, the angle subtending an arc equal to the radius, or $\frac{360^\circ}{2\pi}$. Since every circle

has an equation of the form $P = x^2 + y^2 + ax + by + c = 0$, it follows that if two circles have the equations $P = 0$ and $Q = 0$ (of the same form), if they intersect, the line $P - Q = 0$ will pass through all their finite points of intersection. Even if these points are imaginary, $P - Q = 0$ will be real. $P - Q = 0$ will be in this case the locus of the points from which the tangents to the two circles are of equal length. In either case, it is known as the radical axis of the two circles.

Let us consider the equation of a circle in polar coordinates; it is $\rho \sin(\theta + a) = a + b\rho^2$.

If we substitute $\frac{1}{\rho'}$ for ρ , we get $\frac{1}{\rho'} \sin(\theta + a) = a + \frac{b}{\rho'^2}$. This is also

the equation of a circle. It follows that if we take any circle, such as the unit circle about the origin, and exchange every point for one which is on the same radius vector from the origin, but at a distance from the origin which, when multiplied by the distance from the origin of the first point, gives the square of the radius of the circle, we shall retain all circles unchanged

in form. This transformation is called an inversion. The study of all properties of figures which remain invariant under all inversions is the important branch of mathematics known as inversion geometry. The polar of a point is the line connecting the real or imaginary points of tangency of the tangents to the circle of reference from the point. A point is said to be the pole of its polar.

In practical astronomy, metallic circles accurately divided are used to measure angles. The general principle is to have a telescope moving in a given plane, while a divided circle, situated in a parallel plane, measures the angle through which the telescope moves. Verniers or microscopes are used to read the graduated circle with great precision.

The term "meridian circle" is applied to an instrument in which the telescope revolves in the plane of the meridian, and a divided circle measures angles in this plane.

In logic, a circle is the fault of an argument that assumes the principle which it should prove and then proves the principle by the thing which it seemed to have proved. The same fault takes place in definitions when an idea is defined by others which suppose the knowledge of the first. Arguing in a circle is a fault into which men are very prone to fall, particularly in theological discussions.

In astronomy, the heavens being considered as a spherical surface drawn round the earth as center, an imaginary line drawn round the heavens so as to lie in one plane is a circle of the sphere. It is a "great circle," if the plane of it passes through the center; thus the celestial equator and the ecliptic are great circles; if the plane of the circle does not pass through the center, it is called a "small circle"; all parallels of declination are small circles.

See also GEOMETRY, various subheadings.

CIRCLE, Magic, a space in which sorcerers were wont to protect themselves from the fury of the evil spirits they had raised. This circle was usually formed on a piece of ground about nine feet square (in the East seven feet appears to have been considered sufficient), in the midst of some dark forest, churchyard, vault, or other lonely and dismal spot. It was described at midnight in certain conditions of the moon and weather. Inside the outer circle was another somewhat less, in the center of which the sorcerer had his seat. The spaces between the circles, as well as between the parallel lines which enclosed the larger one, were filled with all the holy names of God and a variety of other characters supposed to be potent against the powers of evil. Without the protection of this circle, the magician, it was believed, would have been carried off by spirits.

CIRCLE OF CURVATURE. When a point in motion is tracing out any curved path, the direction of motion changes from point to point of the curve, and the path is said to be more or less curved according as the direction of the motion of the point changes more or less rapidly. The curvature at any point is measured by the rate of this change at the point per unit length of the curve.

In the case of the circle the curvature is the same at every point; and it is easy to show that the curvature measured as above is equal to the reciprocal of the radius of the circle.

If we consider any small portion of any curve whatever, it may be approximately taken as an arc of a circle, the approximation being closer and closer to the truth as the portion considered is smaller and smaller, and by taking it small enough we may make the approximation as close as we please. The curvature is then the reciprocal of the radius of this circle.

The circle which coincides more nearly than any other with the arc at any point of any given curve is generally found by means of the methods of the differential calculus. Such a circle is called the circle of curvature, and sometimes the osculating circle. The radius of it is called the radius of curvature of the curve at the point considered; and the center of this circle is called the center of curvature. See also CALCULUS, THE INFINITESIMAL.

CIRCLEVILLE, sür'k'l-vīl, city, Ohio, seat of Pickaway County, on the Scioto River at an altitude of 680 feet, 25 miles south of Columbus. It is on a state highway and is served by the Pennsylvania, and the Norfolk and Western railroads. South are the high, fertile Pickaway Plains—corn, hog, and poultry country. Canned vegetables, pork products, and meal are produced and brooms are manufactured. The Public Library Memorial Hall has a miniature of the octagonal Indian mound builders' forts, which became the site of Circleville. In 1810 the city was laid out within the old site on a circular plan, but after a fire in 1841, the city was replotted. The Ohio and Erie Canal, whose old bed can be seen beside the highway, brought prosperity as a shipping point for corn, pork, and lard. It became a city in 1853, and has a mayor and council form of government. Nearby are the sites of Cornstalk town; Camp Charlotte, where Cornstalk, the Shawnee Indian chief, was killed; and Logan Elm State Park, where Logan (q.v.), Mingo Indian chief, uttered his famous lament on the killing of his family. Pop. (1950) 8,723.

CIRCUIT, Electric, a conducting path for electricity, an electric current. In order to use electricity, an outgoing conducting path must be provided from its source to the point where it is to be used, together with a return conductor. These outgoing and return conducting paths form an electric circuit.

There are two fundamental electric circuits: the series and the multiple. A good example of a series circuit is in the small string of lights used for decorating Christmas trees. Here about eight small lights are connected in series. If one light goes out, all lights are extinguished, because the circuit is through each light. A multiple circuit is one where each light is independent of all others. The turning off and on of one light does not disturb the others. The multiple circuit is similar to a ladder where the rungs or steps represent the individual lamps and the side pieces represent the main circuit. The combination is called a multiple circuit. (See ELECTRIC DISTRIBUTION SYSTEMS for diagrams of these and other electrical circuits.)

The term circuit is applied to practically all electrical systems and apparatus. In an electric generator we have an armature and a field circuit; in a transformer, a primary and a secondary circuit; in a relay, a coil or magnetic circuit and a switch circuit. A circuit is said to be closed when an electric current can pass through it. It

is open when the circuit is broken. When a switch is turned on the circuit is closed. Turning off a switch opens the circuit. There are many types of circuits used in every branch of the electrical industry. A short circuit denotes a fault where electricity tends to take a short cut or path in its return to its source. An inductive circuit contains inductance. A two-wire circuit contains two wires or conductors; a three-wire, three conductors; and so on, according to the basic electrical system used. In radio and television many types of circuits are used. The telephone and telegraph systems require many circuits.

For a complete coverage of electric circuits from a technical standpoint, see *Electric Circuits*, by members of the staff of the Department of Electrical Engineering, Massachusetts Institute of Technology (New York 1940).

E. S. LINCOLN,
Electrical Consultant.

CIRCUIT, Judicial, a subdivision of a state or country, effected by constitutional provision or legislative action for the purpose of defining the territorial jurisdiction of its courts; also sometimes called a judicial district or department. State constitutions in the United States generally either divide the area of the state into judicial circuits or confer power upon the legislature to make such a division. A circuit may consist of one or more counties, but does not necessarily coincide with county lines. In the absence of a constitutional restriction, a single county may be divided into two or more circuits. Typical guiding principles in the creation of judicial districts are accessibility and convenience, requiring legislatures to give due regard to the territory affected. Thus the establishment of an unreasonably large circuit, or one which is divided by natural boundaries difficult to traverse, such as rivers, may under some circumstances violate the applicable constitutional provisions. Other constitutional requirements governing the creation of circuits relate to equality of population, extent of territory covered, total number of districts in the state, contiguity of counties in the same district, and the business involved in the districts.

The judicial power of the United States is defined by the Constitution, which vests it in the Supreme Court and in such inferior courts as Congress may from time to time establish. Pursuant to this provision, the United States is divided into 11 judicial circuits, as follows: District of Columbia; first, composed of Maine, Massachusetts, New Hampshire, Puerto Rico, and Rhode Island; second, composed of Connecticut, New York, and Vermont; third, composed of Delaware, New Jersey, Pennsylvania, and the Virgin Islands; fourth, composed of Maryland, North Carolina, South Carolina, Virginia, and West Virginia; fifth, composed of Alabama, the Canal Zone, Florida, Georgia, Louisiana, Mississippi, and Texas; sixth, composed of Kentucky, Michigan, Ohio, and Tennessee; seventh, composed of Illinois, Indiana, and Wisconsin; eighth, composed of Arkansas, Iowa, Minnesota, Missouri, Nebraska, North Dakota, and South Dakota; ninth, composed of Alaska, Arizona, California, Guam, Hawaii, Idaho, Montana, Nevada, Oregon, and Washington; and tenth, composed of Colorado, Kansas, New Mexico, Oklahoma, Utah, and Wyoming. Each of these circuits has a court

of appeals, which serves generally as a tribunal reviewing the decisions of the federal district courts, and in addition as a reviewer of the orders of administrative bodies, when provided by statute.

Prior to the establishment of the modern system of appeals courts for the circuits, there were numerous circuit courts having original jurisdiction of many kinds of suits as well as the power to review cases on appeal from the district courts. These courts were established by various acts of Congress dating from 1789 and were abolished in 1911, at which time one court of appeals was created for each of the then existing nine circuits. In 1929 the eighth circuit was divided and the tenth circuit was formed from states formerly a part of the eighth. The District of Columbia has long been recognized as a separate circuit by the Supreme Court and by many acts of Congress.

RICHARD L. HIRSHBERG.

CIRCUIT RIDER, a traveling preacher, usually of the Methodist Church, who visited rural communities not having a church of their own. His journeys on horseback brought him fairly regularly to a community at expected intervals according to the amount of territory to be covered. He had to be a good preacher, accustomed to hardship and outdoor life, ready to preach in any sort of building, even a tavern or a barn. Originating in England with John Wesley in the 18th century, the circuit rider came to be a typical feature of early frontier life in the United States.

CIRCULAR NUMBERS, numbers whose powers end on the same figure as they do themselves: such are numbers ending in 0, 1, 5, 6.

CIRCULAR PARTS, Napier's Rules for. Invented by John Napier (q.v.), the inventor of logarithms, these rules are for the solution of all cases of right-angled spherical triangles, and were first published in his *Mirifici Logarithmorum Canonis Constructio* (1619). See TRIGONOMETRY.

CIRCULAR POLARIZATION OF LIGHT. See POLARIZED LIGHT.

CIRCULARS AND CIRCULARIZING.

Among the techniques of marketing products and services, the distribution of printed matter devoted exclusively to promoting the product is one of the oldest and most successful. The first printed advertisement in English was a circular—William Caxton's broadside (1477) announcing the publication and sale of a book on conducting religious services. The distribution of public notices and shop bills was common long before the rise of newspaper advertisements. Direct distribution of advertising matter, by hand, door-to-door, or at the point of sale, is widely used; but since the mid-19th century, the use of public carriers, such as the mails, has become the major means of circularizing. The adoption of low postal rates for third-class matter made this technique economically feasible. In the United States, direct mail advertisement is the second largest medium in dollar volume, for over \$1.1 billion (15 per cent of the total) was spent in 1952.

The post office defines a circular as "a printed letter sent in identical terms to several persons." It thus includes form letters, folders, throwaways,

self-mailers, booklets, letters with novelty "gimmicks," price lists, and catalogues, varying in style from elaborate multicolored brochures to simple mimeographed announcements. A unique extension of the mailed circular is the circularized telegram.

Circularizing constitutes the basic marketing method for many businesses, notably the great mail-order houses, which post millions of circular letters each year in addition to their gigantic catalogues. Almost every product is sold through the mail: books, household articles, and industrial equipment. The essential advantage of the mailed circular is that it reaches a segregated, specialized market; the direct distribution of handbills and leaflets, on the other hand, works on a saturation basis.

CIRCULATION, sūr-kū-lā'shūn, passage in a circle, as the circulation of the blood. The term circulatory system is a general one for a group of organs carrying fluids or semisolids from one part of the body to another, the matter being of a nutrient nature. In the case of the blood the system is composed of the deep circulation (heart, great vessels, brain, abdominal organs, and limbs) and the superficial or lesser circulation (superficial tissues such as are in or under the skin). The systemic or general circulation is distinguished from the pulmonary circulation. The lymphatic circulation is connected with that of the blood. All animals, even unicellular ones, have a circulation even if only a single alimentary tube. In plants the circulation is by means of the sap. See also ARTHROPODA; BLOOD; CRUSTACEA; PROTOZOA; SAP.

HAROLD WELLINGTON JONES, M.D.,
Editor, "Blakiston's New Gould Medical Dictionary."

CIRCUMCISION, sūr-kūm-sīzh'ūn, an amputation of the foreskin or of the *labia minora* of the human organs of generation; principally performed on males, but sometimes on females. It has been practiced in all ages and by both civilized and savage races, as Arabs, certain African tribes, Christian Abyssinians, Australian "blacks," Malays, some North American Indians, Aztecs, Mayas, Caribs, South American Indians, Jews, Mohammedans, Fijians, and Samoans.

In the male, the operation consists in removing a section of the prepuce. The original object was religious and symbolic, and its antiquity is lost in the shade of mythology. The institution of the rite among the Jews is recorded in Genesis 17:9-27. Here it is stated that Abraham, then 99 years old, was circumcised, with his son Ishmael, 13 years old, "and all that were born in his house and all that were bought with his money, every male among the men of Abraham's house." But by the terms of the covenant every male among the Hebrews was to be circumcised on the eighth day after birth, and this rule, peculiar to the race, is observed with such rigor that even the Sabbath observances are not allowed to interfere with the ceremony. Other Eastern nations have practiced circumcision on various days—the Arabs 7, 14, 21, or 28 days after birth, though Josephus states that in his day the Arabs circumcised after the age of 13 because the circumcision of Ishmael, their progenitor, occurred at that age; the Mohammedans of Persia circumcise in either the third or fourth year; the Fijians and the Samoans in the

seventh year; the Christian Abyssinians in the sixth, seventh or eighth year; while some of the African tribes that practice the rite follow the Jewish rule; others, again, performing the ceremony between 30 and 60 days after birth.

Circumcision is universally practiced by Mohammedans, not on the authority of the Koran, which does not enjoin it, but as following the example of Mohammed. It seems to be doubtful whether Mohammed's omission to prescribe the rite was due to his deeming such a rule valueless where custom already decreed it, or because he attached only a physiological and not a religious importance to the ceremony. It is, however, now recognized as a religious obligation just as strongly as if it had been ordained by the founder of Islam. Circumcision among Mohammedans may be practiced seven days after birth, but it is customary to postpone the ceremony to some time between the 7th and 12th year.

Christianity recognizes no religious significance in the rite, substituting for it, according to Saint Paul (Rom. 2: 25-29) "circumcision of the heart."

Circumcision of proselytes to the Jewish or Mohammedan faith is insisted on by the orthodox, and previous circumcision for surgical reasons is not accepted as sufficient compliance with the requirements of religion. Among some "reformed" Jews, however, the circumcision of adults has lately been abandoned. Among many savage tribes the rite is undergone at the age of puberty and is perhaps in such instances more of a sociological than a religious ceremony, being akin to other mystic rites which mark the entrance of the young into full tribal fellowship.

The inner significance of circumcision is psychological. It is a purely symbolic rite, the origin of which is lost for the conscious life of the individual. It has no intrinsic medical value whatever, save where some maldevelopment is present. The motive of cleanliness is solely a rationalization to endeavor to explain its deeper psychological significance as a type of racial identification and an index of the father fixation fantasy in the unconscious. The operation is sometimes attended with grave consequences, hence should be done by surgeons only.

CIRCUMFERENCE, or **PERIPHERY**, the curve which encloses a circular, elliptic or other plane area. In figures bounded by straight lines, as the triangle, square and polygon, the term perimeter is employed to designate the sum of all the bounding lines taken together. The length of the circumference depends partly on the nature of the curve; thus, that of the circle of radius r and diameter $d = 2\pi r = \pi d$, where $\pi = 3.141592 \dots$ and that of the ellipse =

$$2\pi a \left\{ 1 - \left(\frac{1}{2} \right) \frac{e^2}{1} - \left(\frac{1.3}{2.4} \right) \frac{e^4}{3} - \left(\frac{1.3.5}{2.4.6} \right) \frac{e^6}{5} - \dots \right\}$$

where a is the semiaxis major, and e the eccentricity. See also **CIRCLE**.

CIRCUMFLEX, in grammar, one of the three accents, formed by the union of the other two, thus $\acute{\circ}$, $\grave{\circ}$. It originally denoted a rising and falling of the tone in the pronunciation

of the syllable. In Greek it is used in certain cases to indicate the long vowel of the last syllable or of the penult. In Latin the mark is Λ . It is not used in English, and in French is usually a sign of the elision of a letter, often the letter s , and therefore indicates a prolonged sound.

CIRCUMNAVIGATION OF THE WORLD. See **AROUND-THE-WORLD RECORDS**.

CIRCUMNUTATION, the continuous motion of every growing part of a plant, in which it describes irregular elliptical or oval figures. The apex of the stem, for instance, after pointing in one direction, moves round till it points in the opposite direction and so on continuously. The term circumnutation was first used by Darwin.

CIRCUMPOLAR STARS, stars near the Pole that appear to move around it, and perform their circles without setting. A star whose polar distance is less than the latitude of a place in the same hemisphere will never set at that place. If the place is in the other hemisphere it will never rise. They are constantly used by astronomers in connection with meridian work for determining latitude of a place or the azimuth of a line. The pole-star Polaris or Alpha Ursae Minoris, usually known as the North Star, is the most used for that purpose.

CIRCUMSTANTIAL EVIDENCE, evidence which tends to prove a particular fact by the proof of other facts, from which it is concluded that the particular fact must have happened. It is the natural and reasonable inference resulting from facts which have been established.

If A is on trial for the murder of B, and a witness testifies that he saw A shoot B, and a few minutes later B died, that would be direct evidence; whereas if the witness testified that B had been shot and the bullet found in the body of B was of a particular make only used by A and that A was in the neighborhood at the time of the shooting, the jury might infer that A was guilty; but if A could prove that his pistol had been stolen from him shortly before the shooting and he had not recovered it at the time of the shooting, it would be a complete defense and the verdict would depend on the credibility of the witnesses.

Circumstantial evidence is of two kinds: that from which a certain conclusion necessarily follows and that from which a certain conclusion is only probable or likely. If the body of a man is found with a bloody right hand impression on a part of his body where it is impossible for him to put his right hand, the presumption is that some one was present at or since the time the person was hurt; but if that is all of the evidence, it is impossible to tell whether the bloody impression was made by the person at the time of the assault, or by some one after the assault had been committed. In civil cases the jury may decide according to the weight of the evidence; but to convict a person of a crime the evidence must be such as to leave no reasonable doubt as to his guilt. See **CRIMINAL LAW**.

CIRCUMVALLATION, a fortification consisting of a parapet of earth and a trench, constructed by a besieging army around its camp, to guard against attempts to relieve the place besieged.

CIRCUS. A Latin word used by pre-Christian Romans to denote the circuit made by racing chariots. Eventually it denoted the rectangular, oval or circular enclosure where Roman sports and pastimes were sponsored by Roman rulers for the entertainment of their, perhaps restless, subjects. For centuries these politically inspired athletic and wild animal performances were given to vast audiences of Roman subjects in Italy, Gaul, England and other parts of the Roman Empire. Better known of these circus enclosures was the Circus Maximus, an amphitheater 625 feet wide, 1,875 feet long with rounded ends. From both ends and from one side rose tiers of seats from which 260,000 spectators could cheer the winners of the races, gladiatorial combats, or the slaughter of defenseless Christians by Numidian lions. As an added attraction, the Roman Caesars built a canal or waterway inside the enclosed area and thus offered aquatic contests as well as ground acrobatics and wild animal exhibits.

Most imposing of the Roman amphitheaters was the Colosseum adjoining the Forum, erected of stone by Emperors Vespasian and Titus during the first Christian century, for the accommodation of 50,000 spectators on its soaring tiers of seats.

During the 15th and 16th centuries the Roman chariot races and athletic contests, the trained animal shows characteristic of fairs, and the buffoonery of white-faced clowns merged into the traveling or semipermanent European circus featuring equestrian performances and clowning. Given in taverns or coach yards to the music of fife and drum, rewarded by collections of coppers, these persistent groups struggled across Europe until a retired British soldier "Mr. Astley, Sergeant-Major in His Majesty's Royal Regiment of Light Dragoons" established himself as a trick horseman in a wooden building near the Half-Penny Hatch Inn, London, in the 1770's. That father of the modern circus was followed by the Franconi's of Italy and France and by John Bill Ricketts who came to America to run a riding school and who rode for pleasure with Gen. George Washington. Thus Philip Astley, the Franconi's, John Bill Ricketts and other hard working performers and animal trainers, laid the foundation for America's rolling shows, little families or groups of acrobats and clowns who toured the eastern United States by horsepower, performing inside a roofless canvas wall, weather permitting, during the 1820's.

By the 1830's a hustling Yankee named Phineas Taylor Barnum had started out from Connecticut as a "rolling showman" with a canvas-topped tent. Arriving in each village in the early morning, performing afternoons and evenings if possible, tearing down and packing up, driving to the next likely hamlet, the rolling shows made adventurous history for circusmen.

Barnum, amassing some money by lecturing and by exhibiting a midget billed as Tom Thumb, found himself eventually part owner of Barnum & Bailey's Greatest Show on Earth, boasting the world's greatest collection of elephants and other animals, giving performances in three rings enclosed by a hippodrome track and seating ten

thousand applauding and money-paying customers, under the "big-top."

In performance, physical planning, costuming and effect it was a combination of the Circus Maximus and the Colosseum brought down to date, except that it moved about the country in its own railroad cars with its canvas city owned and managed by citizens rather than by their rulers.

One of those husky competitors was a family of seven Ringling Brothers from Baraboo, Wis. By 1890, the Ringling Brothers circus was Barnum & Bailey's biggest rival. When Bailey died in 1906, the "busy brothers from Baraboo" paid \$410,000 for the Barnum & Bailey Circus title and property. When "Mr. John" Ringling, last of the Ringling Brothers, died in 1936 he left not only the ownership of the Ringling Brothers, and Barnum & Bailey Combined Shows — The Greatest Show on Earth. He also left six other large circuses which he had acquired by purchase.

In 1950, the Ringling-Barnum Circus was on tour on a hundred, all-steel, circus-owned, double-length railroad cars. It owned more than thirty elephants as features of its menagerie. It seated 10,000 in its main tent or "big-top," and it was owned by the Ringling Family, John Ringling North as president; Henry Ringling North as vice president. In spite of steadily increasing competition from motor cars, airplanes, motion pictures, radio and video, American circuses exhibit to more than 20,000,000 customers, annually.

EARL CHAPIN MAY.

CIRENCESTER, sî'rên-sēs-tēr, England, town in the county of Gloucester, on the river Churn, 17 miles southeast of the city of Gloucester. The chief industries are malting, brewing and cutlery manufacture; it also has a large wool trade. The town contains the remains of the gateway of an abbey founded in 1117 and several churches of interest. In the environs is the well-known Royal Agricultural College, with a large number of students coming from all parts of the world. It is an important live stock and wool market. Cirencester was founded by the ancient Britons, and later, under the name of Corinium, became a Roman station. Various Roman remains, including those of an amphitheater, have been discovered in it, and numerous relics belonging to this period of its history have from time to time been discovered. Pop. (1938) 7,209.

CIRILLO, chē-rēl'lo, **Domenico**, Italian physician, republican, and naturalist; b. Grugno, Naples, 1734; d. Naples, Oct. 29, 1799. He officiated in early life as professor of botany, travelled to France and England, became a fellow of the Royal Society of London, a friend of Buffon, D'Alembert and Diderot, and on his return to Naples was appointed physician of the court. After the proclamation of the republic by the French, he was chosen representative of the Neapolitan people, and member of the legislative commission (1799); and on the re-establishment of royalty suffered death on the scaffold, rather than take the oath of allegiance or ask a pardon from King Ferdinand. His principal writings are *Fundamenta Botanica* (1787); and *Entomologiae Neapolitanæ Specimen* (1787).

CIRPAN, chîr-pân', a town of eastern Rumelia, Bulgaria, on the tributary of the Maritza,

40 miles east of Plovdiv. It is situated in a fertile, fruit-producing region and is noted for its mineral springs. Pop. about 12,000.

CIRQUE, *sûrk*, a broad amphitheater-like valley head, also sometimes called a glacial bowl. It is usually the gathering ground for the snow and névé that form the glacier. Cirques usually have steep rock walls and are often occupied by small lakes. They constitute a striking feature of mountain landscapes in glaciated regions. As the bergschrund crevasse is formed at the head of the glacier, where the ice pulls away from the rocky walls, these walls are exposed to frost work, which loosens large blocks of rock. Each winter, with the accumulation of new snows, these loosened blocks freeze into the glacier and are dragged away down the valley. Thus the valley head grows until a cirque is formed. See **BERGSCHRUND**.

CIRRHOISIS. A chronic progressive inflammatory disease of the liver. It is characterized by an overgrowth of connective tissue and by degeneration of cells of the parenchyma in some areas with regeneration in others. The disease is known also as biliary cirrhosis and exists in two forms, the primary (Hanot's cirrhosis), which is rare, and secondary or obstructive cirrhosis. The latter follows persistent obstruction of the common bile duct. It is accompanied by jaundice and is most often caused by cancer of the head of the pancreas. Next in order is inoperable obstruction of the common duct or extensive involvement of the duct in scar tissue from adhesions. The liver is usually enlarged. Sometimes the condition can be relieved surgically by removing the biliary obstruction. The disease is also caused by syphilis and this form may be alleviated by antisyphilitic treatment. There is not much evidence to support the view that cirrhosis is caused by alcohol. The term cirrhosis is sometimes applied incorrectly to indicate kidney disease and also lung fibrosis. The prognosis in cirrhosis is extremely variable. It will depend somewhat upon the type and whether or not the cause is removable. Complete recovery cannot be expected. See **LIVER**.

CIRRIPEDIA, an order of entomostracous Crustacea (barnacles), sometimes ranked as a subclass, always fixed in the adult stage, but with free-swimming larvae having three pairs of appendages (*nauplius*) like other Crustacea. The typical barnacles have the body enclosed in a reduplication of the skin which secretes a calcareous shell, on which account they were classed with the Mollusca until the discovery of their free-swimming larvae led to a closer investigation of their structure. Owing to adaptation to a sedentary life segmentation of the body has become obscure, and the six pairs of jointed biramous appendages are mere fringed scoops for creating currents in the water. The eyes and other sense organs have likewise degenerated, and most species are hermaphroditic. The barnacles are exclusively marine, and a great many are parasitic.

Four suborders are distinguished: (1) Thoracica, including the typical, free-living, shelled barnacles of which the sessile forms (*Balanidae*, *Coronulidae*, etc.) are well known as rock and ship barnacles in which the animal is pro-

tected by a conical shell formed of several pieces, with a multivalve conical movable lid, having an opening through which several pairs of long, many-jointed, hairy appendages are thrust, thus creating a current which sets in toward the mouth. The young have oval bodies, with a single eye, a pair of antennae, with three pairs of legs. After swimming about for some time it attaches itself by its antennae to some object, and now a strange backward metamorphosis begins. The body becomes enclosed by two valves, the stalk by which it is anchored grows larger, the feet become more numerous and eventually the barnacle shape is attained. The goose barnacle (*Lepas*) is not sessile, but is flat and triangular, and attached to floating bits of wood or seaweed by a long, large, soft stalk. (2) Abdominalia, parasitic barnacles, in which the sexes are separate and very unequal in size. In this group is presented the remarkable phenomenon of dwarfed complementary males discovered by Darwin. The females live in burrows in the shells of mollusks and other barnacles, while the males are minute, lack mouth, digestive canal and appendages, and live, often several together, permanently attached to the female. (3) The Apoda, whose body is maggot-shaped, are hermaphrodite and parasitic in other barnacles. (4) Rhizocephala: This group presents perhaps the most extreme cases of degeneration, through parasitism, known among animals. *Sacculina*, which attaches itself to the abdomen of the crab, is little more than a bag of genital organs which draws its nourishment from the tissues of its host by means of branching rootlike processes which penetrate to every part of its body.

CIRRUS. See **CLOUDS**.

CIRRUS, in botany, the tendril by means of which certain plants climb, usually a modified leaf or the prolongation of a midrib.

CIRSIIUM, a genus of plants belonging to the family Asteraceae, generally known as thistles, common in most temperate regions. Many of them are troublesome weeds. Among the more common of them are *C. arvense* (corn-thistle, way thistle or creeping thistle), which has strong fleshy roots extending underground, and is difficult of extirpation; and *C. lanceolatum* (spear thistle), which, both from its size and rough feeding, is a great robber of the soil, but being only a biennial is more easily managed.

CIRTA, *sûr'tà*, city, northern Africa, the capital of the Numidian prince Syphax, and an important fortress of Masinissa and his successors. Later it became a flourishing Roman colony. It was much injured by the troops of Maxentius in 310 A.D., but was restored by Constantine and named Constantina. The modern Constantine (q.v.) in Algeria occupies its site.

CISALPINE REPUBLIC, former state, Italy, located in the northern part. After the Battle of Lodi, May 10, 1796, Gen. Napoleon Bonaparte proceeded to organize two states—one on the south of the Po, the Cispadane Republic, and one on the north, the Transpadane. These two were united into one on July 9, 1797 under the title of the Cisalpine Republic, which embraced Lombardy, Mantua, Bergamo, Brescia, Cremona, Verona and Rovigo, the duchy of Modena, the

principalities of Massa and Carrara, and the three legations of Bologna, Ferrara and the Romagna. The nominally independent republic had an area of more than 16,000 square miles, and a population of 3,500,000. The seat of the government or directory was Milan. The army consisted of 20,000 French troops, paid by the republic. The republic was dissolved for a time in 1799 by the victories of the Russians and Austrians, but was restored by Bonaparte after the victory of Marengo and some modifications of constitution were made and the area was increased. In 1802 it took the name of the Italian Republic, and chose Bonaparte for its president. In 1805 the republic sent a deputation to Napoleon with authority to give him the title of king of Italy. The territory was known as the kingdom of Italy until 1814. In 1815 it became a part of Austria. Its former territories are now in Italy.

CISCO, sīs'kō, city, Texas; in Eastland County; 40 miles east of Abilene; altitude 1,608 feet. It is served by the Texas and Pacific and the Missouri-Kansas-Texas railroads, and has an airport. Cisco lies in a region which grows livestock, peanuts, and fruits, and has large petroleum and natural gas reserves. The city manufactures work gloves, hydrocarbons, oilfield supplies, and brooms. Lake Cisco, formed by a dam five miles north, provides water and is a recreation center. Cisco was founded in 1881, was incorporated in 1883, and again in 1919. Pop. (1950) 5,230.

CISCO, sīs'kō, a name applied to over twenty of the species and subspecies of *Leucichthys*, a genus of the whitefish family, Coregonidae. The various ciscoes are usually described by a locality name, such as Twin Lakes cisco and Lake Superior cisco, and by such names as tullibee, chub, bluefin or blackfin. These fishes, like the salmon and trouts, have an adipose dorsal fin, but the scales are larger and the mouths are smaller than those of the Salmonidae. Most of the ciscoes belong to the species *artedii*, or one of its subspecies. The genus is the same as the chubs, which they resemble, but which are smaller, on the average. They live in the clear cold waters of northern North America and Eurasia, but their greatest concentration is in the Great Lakes region. They are caught commercially, and large numbers are eaten fresh, smoked, or salted.

Consult Koelz, W., "The Coregonid Fishes of North-eastern North America," *Papers, Michigan Academy of Science, Art and Letters* (Ann Arbor 1930); Hubbs, C. L., and Lagler, K. F., *Fishes of the Great Lakes Region* (Bloomfield, Mich., 1947).

CISNEROS BETANCOURT, sīs-nā'rōs bē-tān-kōort', **Salvador**, Cuban patriot and statesman: b. Puerto Príncipe (now Camagüey), Feb. 10, 1828; d. Feb. 28, 1914. A descendent of a family of the Spanish nobility, with the hereditary title of marqués de Santa Lucía, he nevertheless joined the party of Cuban independence as a youth, being active in various revolutionary organizations in Camagüey. Upon the outbreak of the Cuban revolution of 1868-1878 led by Carlos Manuel de Céspedes, Cisneros joined the insurgents, and succeeded Céspedes as president of the revolutionary government in 1873-1874, but soon relinquished the post. Cisneros was also president, 1895-1898, of the revolutionary

government which was victorious upon the intervention of the United States and the outbreak of the Spanish-American War. After 1898 Cisneros was a senator from Camagüey.

CISPADANE, sīs'pā-dān, **REPUBLIC**, a nominally independent republican state established by Napoleon in Italy in 1796 after the Battle of Lodi. It comprised Bologna, Modena, Ferrara, and Reggio. In 1797 it was united with the Cisalpine Republic (q.v.).

CISPLATINE, sīs-plā'tin, **REPUBLIC**, the name by which Uruguay was known from 1828, when it became independent of Brazil, until 1831. Previously, from 1821 until the revolution of 1825-1828, it had been the Cisplatine Province of Brazil.

CISSAMPELOS, sīs-ām'pê-lōs, a tropical genus of climbing shrubs of the natural order Menispermaceae, whose growth is similar to that of an ivy vine. The plant is of great commercial value because of its medicinal qualities, especially the velvetleaf of Brazil (*Cissampelos pareira*), the root of which supplies the spurious pareira brava, abuta root, used in medicine as a tonic. Other species growing in nearly all tropical countries are used for emetics and cathartics and an East Indian species (*C. oblecta*) yields an intoxicating spirit.

CISSEY, sē-sā', **Ernest Louis Octave Courtot de**, French general: b. Paris, Sept. 23, 1810; d. there, June 15, 1882. He was educated at the military school of Saint Cyr and having served with distinction in Algeria and the Crimea, he was promoted general of division in 1862. He fought in the Franco-Prussian War and against the Commune of 1871. He was elected to the National Assembly in February 1871 and was minister of war from 1871 to 1873 and in 1874-1876. He was elected life senator in 1875.

CISSOID, a curve in geometry, the locus of the vertex of a parabola rolling upon an equal parabola. If pairs of equal ordinates are drawn to the diameter of a circle, and through one extremity of this diameter and the point in the circumference through which one of the ordinates is let fall a line is drawn, the locus of the intersection of this line and the equal ordinate is known as the cissoid. This curve was discovered by Diocles while he was seeking the solution of the celebrated problem of the duplication of the cube.

CIST, **Henry Martyn**, American soldier: b. Cincinnati, Ohio, Feb. 20, 1839; d. Rome, Italy, Dec. 17, 1902. He graduated at Belmont College 1858 and began the study of law, but enlisted as a private in the Sixth Ohio Regiment in 1861, attaining, before his resignation in 1864, the brevet rank of brigadier general. He was post adjutant of Camp Chase during the imprisonment of the Confederates captured at Fort Donelson, assistant adjutant general of the Army of the Cumberland and later on the staff of generals Rosecrans and Thomas. After the war he practised law in Cincinnati, was twice mayor of College Hill, originated the project that resulted in the conversion of the Chickamauga battlefield into a national park and was a contributor of military articles to the maga-

zines. He wrote *The Army of the Cumberland* (1882) and collaborated with Donn Piatt in a *Life of General George H. Thomas* (1892).

CISTACEAE, sîs-tă'sê-ê. See CISTUS.

CISTERCIANS, sîs-têr'shāns, -shî-āns, a monastic order—because of their robes also called **GREY or WHITE MONKS**—founded by St. Robert de Molesme who in 1098 established a community at Cîteaux dedicated to the literal observance of the rule of St. Benedict (q.v.). It was above all the prudence and zeal of the third abbot of Cîteaux, English-born St. Stephen Harding (d. 1134), that made possible the expansion of the struggling community into a vigorous new order. Under his rule the first four daughter houses of Cîteaux (La Ferté, Pontigny, Clairvaux, and Morimond) were established between 1113 and 1115, and in 1119 he drew up the *Carta Caritatis*, a code of statutes for the government of the whole order.

The subsequent rapid expansion of the Cistercians was inspired largely by the genius of St. Bernard (See **BERNARD OF CLAIRVAUX**), who joined the order in 1112. At his death in 1154 there were some 280 abbeys, and by the end of that century some 530, over 60 of them in England and Wales.

The Cistercian life was one of poverty, prayer, and arduous labor. There were long fasts and little sleep. Golden ornaments and rich cloths were banished from the altars and the churches themselves were unadorned with sculpture and painting. In aiming at the utmost simplicity, the Cistercians in fact achieved a very pure and beautiful style of architecture; the best surviving example is at Pontigny.

Apart from the austerity of the monks' lives, the Cistercian Order differed from the older forms of Benedictine monasticism in both its constitutional structure and its economic organization. Each house elected its own head but was subject to visitation by the abbot of the founding house, while all the abbots of the order met together once a year in General Chapter. (Cîteaux itself was visited by the abbots of the first four daughter houses.) The monasteries were supported, not by endowments of rents from productive estates, but by the labor of the monks themselves and often undertook the cultivation of great tracts of waste land. To help with this work, and to provide a form of religious vocation for the illiterate peasant, a numerous class of lay brothers was recruited. Through their agricultural activities the Cistercians came to play an important part in the economic life of medieval Europe, especially in the growth of the English wool trade and the opening up of arable land in eastern Europe.

By the middle of the 13th century, however, there were signs of decline from the fervent zeal of the early days, and the circumstances of the 14th century, with its war, plague, and schism, hastened the process of decay. In the later Middle Ages there was a general relaxation in standards of austerity, but also repeated attempts at reform, one of the most notable being that of the Abbot De Rancé of La Trappe (q.v.) in the 17th century. The Protestant Reformation and later on the upheavals of the French Revolution brought about a suppression of nearly all the Cistercian houses in Europe, but during the 19th century there was a substantial revival. In

1892 the order was divided into two observances, the Cistercians of the Common Observance and Cistercians of the Strict Observance, the latter formed by a union of several Trappist congregations. By the middle of the 20th century there were over 3,000 Cistercian monks of the Strict Observance and nearly 1,000 of the Common Observance. There are six Cistercian abbeys in the United States and six in the British Isles.

Consult Janauschek, P. K., *Originum Cisterciensium Tomus I* (Vienna 1877); Guignard, P., *Monuments primitifs de la règle cistercienne* (1878); Vacandard, E., *Vie de S. Bernard*, 4th ed. (1910); Coulton, G. G., *Five Centuries of Religion* (Cambridge, Eng., 1923-50).

BRIAN TIERNEY,
Catholic University of America.

CISTUS, sîs'tûs, or **ROCKROSE**, a genus of low evergreen flowering shrubs belonging to the family Cistaceae. Its 20 species occur naturally in the Mediterranean region, and some species and hybrids are cultivated as ornamentals in the warmer parts of North America. The rose-like flowers are characterized by five white, yellow, pink, or purple petals, and numerous yellow stamens. The juice of the leaves and stems of several species (*C. ladaniferus*, *C. villosus*, *C. laurifolius*) yields labdanum (ladanum), a resinous substance formerly used in medicine and now used in the perfume industry.

CITADEL (from the Italian *cittadella*, signifying "little city"), a kind of fort, consisting of four, five, or six sides, commonly erected on commanding eminences within towns. It is distinguished from a castle by having bastions.

CITATION, a bay thoroughbred colt, foaled in 1945, that was bred by Warren Wright at Calumet Farm. Citation was sired by Bull Lea out of the dam Hydroplane II, whose sire was the English stallion Hyperion. One of the all-time "greats," he was pronounced Horse of the Year in 1948, after he had won the triple crown: the Kentucky Derby, Preakness, and Belmont Stakes. During his four seasons of campaigning he won eight out of nine starts as a two-year-old, 19 out of 20 as a three-year-old, and out of his entire racing career of 45 starts, he was first 32 times, second 10 times, third twice, and he won altogether \$1,085,760. He was retired in 1951.

CITATION, *in law*, a court order to appear; the act of quoting an authority to support a legal argument, or the authority so quoted. In its first sense, citation is substantially the equivalent of summons, denoting a writ or other formal process judicially issued, commanding appearance in court at a specified time to answer a petition or complaint, or for some other particular purpose. In its second sense, the term refers to the reading, production of, or reference to legal authorities and precedents, or to the material so read, produced, or referred to.

In *military* and *social usage*, citation denotes a specific mention for gallantry or merit in military orders and dispatches, as well as in the conferring of an honorary academic degree.

CITHARA, sîth'à-râ, a guitarlike musical instrument, said to have been invented by Apollo. The strings, usually five or six in number, were struck with a plectrum, or picked with the fingers. It was the forerunner of the banjo, guitar, zither and similar instruments. See **LYRE**.

CITIES OF REFUGE. According to the law of Moses, six out of the 48 cities which the Israelites were directed to give to the tribe of Levi, in the division of the land of Canaan among their tribes, were to be set apart as cities of refuge for those who were guilty of unintentional murder. The right of avenging murder belonged to the next of kin of the murdered man; but the slayer fleeing to one of these cities, the avenger was forbidden to touch him until he stood judgment, when, if he were found to have acted without premeditation or malice, he had a residence appointed him in the city of refuge until the death of the high priest, and was then permitted to return to his inheritance. If the slayer violated this regulation by leaving the city of refuge before the death of the high priest, the avenger might kill him with impunity. The six cities of refuge were Kedesh, Shechem and Hebron on the west side of the Jordan; and Bezer, Ramoth-Gilead and Golan on the east.

CITIZEN OF THE WORLD, the signature of Oliver Goldsmith's *Letters from a Chinese Philosopher residing in London, to his friends in the East*. The work was published in 1762.

CITIZENSHIP. Political Citizenship.—A citizen is commonly defined as one who owes allegiance to a government and who is entitled to protection by that government. At least four concepts seem to characterize the relationships between the individual and the community which are designated as citizenship. Each of these contains a group of theories, rules, and arrangements. These four areas of concern are: membership in the socio-political group; freedom of individual action; protection of person and property, in some instances even from the state itself; and responsibility of the individual to the group.

When and where did these ideas of citizenship develop? The rise of city-states and the surge of nationalism which followed in Europe during the 17th and 18th centuries led political leaders to institute programs and promulgate legislation which would foster traditions of civic allegiance on the part of the populace. During the same period emerging economic practices required protection for citizen capitalists. Such practices, however, were based in part upon the writings of the moral philosophers, from the Stoics to Jean Jacques Rousseau, who had long propounded ideals which called for the development of individuals who possessed the attributes of free, democratic citizens. Other principles of citizenship can be traced back to the Hebraic-Christian tradition; medieval western man had been influenced to serve as a universal citizen in Christ. Practices of feudal barons and their liege subjects were forerunners of citizenship aspects concerning service to the state in exchange for protection, as well as being forerunners of citizenship aspects concerning the varied rights of community membership.

More often, the American and French revolutions are cited as progenitors of the modern theory of citizenship. In the light of the history of the evolution of government, ideas of citizenship are of comparatively recent origin, since most citizenship definitions include specifically the inherent right of the individual to partake in the government. Such a description of the citizen eliminates a number of the members in many political communities. In ancient Greece the citi-

zens were an elite group; in Rome, until the establishment of empire citizenship about 200 A.D., the prerogatives and duties of the citizens marked them apart from the masses. In most modern states, slaves and other individuals without rights have largely disappeared; but we continue, in a legal sense, to need and use other categories besides that of citizen for individuals who have limited rights in a particular nation.

The term "subject" is sometimes used for persons with restricted franchise. Residents of colonies or territories may be so designated. The term has not found favor because of its association with theories of absolutism. In some instances the term "ward" is used instead of "subject." States having popular forms of government and peoples who disfavor the monarchical type of government have tended rather to use the term "national" for persons who owe allegiance to a state but do not enjoy the full rights and privileges in that country. For example, although qualified in all other ways for citizenship, a member of a dependent tribe may be denied the right to vote. In American Samoa, unless a native has one parent who is a citizen of the United States, he is designated as a national of the United States and enjoys no voting privilege.

The term "alien" refers to a person residing or traveling in a state who owes allegiance to and is a member of another nation. His rights and duties have been fixed by international law, by treaties between different states, and by the statutes of the state in which he is living temporarily. Aliens are expected to obey the laws of the host state. In the United States, aliens are entitled to the protection of life and property. They may work and earn compensation, send children to public schools, and have the use of the courts. However, they may be denied the right to buy land and the right to draw workers' benefits, and cannot vote. Aliens have been required to register in the United States, but there is no exact count. During the harvesting season, the total number of aliens in the United States has been estimated to rise above 5 million.

The term "declarant" is often used to designate an alien who has initiated the process of acquiring citizenship in the host state. His rights depend upon the laws of the given state; usually a person who indicates such intentions will gain the protection of the host country while remaining within its boundaries. Should such an individual return to the nation in which he has renounced citizenship, he cannot expect protection by either state. Such a person, commonly called an expatriate, can be seized by officials in his original state, which may not have recognized his right to change citizenship, and he may be faced with charges of back taxes or unfulfilled military duty.

Citizenship in a state may be acquired in a number of different ways. The most frequent means is by virtue of either the parentage or the place of birth. The next most common method is by the process of naturalization, whereby aliens may acquire citizenship when formally granted by a state.

The two principles related to descent or place of birth are frequently in conflict. The oldest of these is known as the *jus sanguinis* (law of the blood) which was a feature of Roman law and has become the most dominant. It is now accepted by the majority of nations, usually in some combination with the second practice. Under *jus sanguinis* the offspring gains the nation-

ality of one or both parents. The *jus soli* (law of the soil) principle rose during the feudal period, which emphasized the import of the idea of territorial sovereignty; here the place of birth, regardless of parental citizenship, becomes the decisive factor. A recent survey revealed 17 nations basing their nationality laws solely upon *jus sanguinis*, 25 principally upon *jus sanguinis*, and 2 equally upon *jus sanguinis* and *jus soli*, with 26 other countries basing their citizenship laws principally upon *jus soli* and partly upon *jus sanguinis*.

The United States follows the method of *jus sanguinis* only in part. Any person born of parents who are both citizens of the United States and one of whom has resided in the United States is automatically a citizen, irrespective of his place of birth. In cases of birth outside of the United States, when one parent is not a citizen, the child, to become a citizen, must live in the United States for five years between the ages of 13 and 21. On the other hand, following the method of *jus soli*, the United States recognizes as American citizens all persons born in the United States, except the children of foreign diplomats. Here the law of the soil supersedes the law of the blood and, for example, a child of two Japanese aliens born upon American territory is recognized as a citizen of the United States.

The United States had no national laws concerning citizenship until after the Civil War. From the inception of the government in 1788, the United States had accepted English common law, the laws of the several states, and the place of birth as determining factors. Some conflicts were resolved by court decision and by the secretary of state and the attorney general. Thus, the 14th Amendment, adopted in 1868, which declares that "all persons born or naturalized in the United States, and subject to the jurisdiction thereof, are citizens of the United States and of the State wherein they reside," became the first law of American citizenship. Much piecemeal legislation followed through the years. Certain Orientals were excluded; liabilities restricting the possibility of gaining citizenship by naturalization were enumerated and refined; Puerto Ricans were made citizens in 1917; nationality quotas were established and adjusted for immigrants; women's citizenship rights were defined and broadened; and in 1924 the American Indians were finally granted full citizenship.

The United States Nationality Act of 1940 repealed all prior acts but retained most of their main features. It provided that naturalization should be limited to white persons, persons of African nativity or descent, and to descendants of races indigenous to the Western Hemisphere. Filipino persons were also made eligible. The act was amended in 1943 to include Chinese persons and persons of Chinese descent. Other present qualifications for naturalization include: age of at least 21; ability to speak English; devotion to American constitutional principles; legal entry into the United States; renunciation of former allegiance; an oath of allegiance to the United States; and evidence of good moral character, including proof that the applicant is neither a polygamist nor an anarchist. Following five years of consecutive residence in the United States and naturalization by a federal or state court of record (those with unlimited jurisdiction), the new citizen stands on completely equal footing with native-born Americans, except for the con-

stitutional provision that he may not become president of the United States. The source of the certificate of naturalization and the list of provisions necessary for naturalization vary considerably from country to country.

In addition to attaining citizenship via birth or naturalization, other modes have been followed. These include: marriage, adoption, long residence (Brazil), land purchase (Mexico), entrance into the public service of a nation (Norway), and political incorporation of a foreign territory. It was by annexation and treaty that the inhabitants of Florida, Louisiana, Texas, California, Alaska, and Hawaii became citizens of the United States.

Great Britain, like the United States, combines the systems of *jus sanguinis* and *jus soli* with regard to children born to their nationals at home or abroad and with regard also to the children of aliens born on their territory. Great Britain extends this right to all ships entitled to its nationality; the United States has not so extended its law. In cases of conflicting citizenship, English law tends to consider territorial nationality as dominant. Great Britain also attempted to bring its citizenship laws up to date by the British Nationality Act of 1948. Members of all self-governing countries within the Commonwealth were entitled to the nationality of their own countries but were granted also the status of British subjects as Commonwealth citizens. This act thereby established a commonality of recognition throughout the Commonwealth. The law also provided a common citizenship, binding citizens of the United Kingdom with those in the colonies. As in the case of the United States, which confirmed equal citizenship rights upon its women in 1934, a British woman does not lose her nationality upon marrying an alien; an alien woman does not become a citizen through marriage to either a British or an American citizen. In both countries, however, it is easier for such a spouse to become naturalized than it is for a typical immigrant.

With the increased migration of peoples throughout the world, the recent great wars which have displaced millions of persons, and the gaps in international law concerning citizenship and nationality, conflicts between the principles of the law of the blood and the law of the soil have brought a greater number and variety of problems for individuals and nations. In addition, other conflicting nationality laws of the various governments, often including racial prohibitions, plus the failure to evolve reciprocal treaties on these matters have brought increased international friction and many more persons with confused or dual citizenship, as well as numerous stateless persons, men and women without any country. The basically opposing views on the citizen and his position in the state held by governments of majority rule and nations of minority rule have served to create many important citizenship problems.

It is easy to visualize cases of conflicting citizenship. German law under the Nazis held strictly to *jus sanguinis*; Argentine law was based solely upon *jus soli*. What was the position of a young man born of German parents under Argentine jurisdiction? States such as Russia and Turkey once held that there was no way a person could give up citizenship in those states. The Italian Fascists revived such theories in attempting to regain control of emigrants to North and

South America. The United States has held that in cases of dual citizenship where, for example, a child born of French parents in the United States has American citizenship according to its laws but is also looked upon as a French national by French statute, he has the right upon reaching the age of majority to declare for one or another of his national ties. Many other nations have failed to accept this doctrine. In recent years double nationality has been reduced by treaty and emerging international law, but the conquests and movements of peoples which marked World War II brought many new cases.

One other form of dual citizenship confronts the citizens in a federal state. They owe allegiance and have special rights and duties in connection with both their state and national governments. A typical example of resulting conflicts is the vexatious problem of multiple taxation. In the United States, following economic and political developments, court decisions, and a Civil War, national citizenship became accepted as supreme. The federal Constitution, courts, and legislation now provide the ultimate civic authority. This is a typical development in many other federated states. Citizens in the United States also face problems of interstate citizenship. Although the Constitution provides that the citizens of each state shall be entitled to the privileges and immunities of citizens in the other states, attempts have been recorded whereby a state has acted to discriminate against citizens of other states in favor of its own. However, high out-of-state fishing and hunting fees and increased tuition charges for non-resident scholars have been upheld by the courts as not being violations of the fundamental rights of the citizen.

The stateless person has no citizenship. Such an individual may have committed a crime providing for the punishment of loss of national rights; in the United States prisoners merely surrender some of their rights temporarily, during the period of their incarceration. Refugees make up the bulk of stateless persons. A refugee from the Soviet Union, East Germany, or some other country may often be ineligible for citizenship in the country of asylum but may at the same time have lost his natal citizenship. Some small countries have been wiped off the map. Some persons have no record of where they were born or of who their parents were. An individual may lose his citizenship through military service for a foreign nation, yet not gain citizenship in that country. Immigrant declarants who have given up their allegiance to their home nations and have not as yet completed the naturalization process in their new countries are also stateless for that period of time. Some individuals lose their native citizenship because they reside abroad too long; meanwhile, having failed to initiate steps to acquire the nationality of their adopted states, they become men without countries. The United States now requires forfeiture of citizenship for naturalized citizens who live for two years in foreign states of which they were once nationals. If such an individual lives in any other foreign nation for five consecutive years, he also forfeits his American citizenship.

Citizenship Education.—All nations use their schools to promote patriotism. They desire to develop young persons who have the necessary knowledge and understanding and who hold the values and ideals which will lead them

to satisfying and competent roles as citizens of the state. Citizenship education has come to mean much more than a grasp of the facts of governmental structure and function. In a broad connotation it may be stated that citizenship education is the central and all-pervading purpose of the schools in a free society. Such schools have a heavy responsibility. They must provide those learning experiences whereby the student comes to comprehend and believe in democracy, and particularly wherein he has the opportunity to build those skills which enable him to function as an intelligent individual and contribute to the general welfare.

In medieval times citizenship education was tied closely to the church and to religious education. This alliance has persisted to the present. The dominant Lutheran element was long reflected in provisions for religious instruction in German schools. In Italy the state has an agreement with the Catholic Church whereby the two are partners in education. Such religious influence in public education has waned in a number of countries. Following the Middle Ages, with the Renaissance, the rise of nationalism, the growth of an economically influential middle class, the spectacular power revolution, the gradual enfranchisement of the masses, and finally the anarchy stemming from the French Revolution, the need became ever more apparent for the state to become actively involved in the educational process. Naturally, the content of education for citizenship varies greatly, depending upon a nation's philosophy and its form of government. The education of Spartan youth was, for example, quite different from the upbringing of the youth of Athens. Modern totalitarian nations, which believe, as did the Spartans, that the individual exists for the state, have instituted educational programs based on the leadership-follower principle. Their schools entail practices which are radically opposed to those followed in nations that are dedicated to majority rule, liberty of the individual, and faith in the reason of the common man.

In the United States there has been great controversy during the past half century concerning the kind of general, basic, or civic education most fitting for the development of socially competent individuals. Many agree that the schools must teach more than the "three R's" and political civics; but there is considerable disagreement about the new content and particularly about the method by which the revised objectives are to be reached. There seems to be, however, emerging consensus as to certain appropriate essentials of American citizenship education. These include the following eight aspects:

(1) It is held that a comprehensive, planned program of civic education, spread across all the years of schooling, should be based upon a thorough knowledge of United States history and government, including an emphasis upon the Constitution and our political institutions.

(2) Dedicated teachers, responsible for the social education of American youth, expected to believe in the American way and to promote loyalty by inculcating these attitudes in their students, are held essential.

(3) Regular reiteration of the fact that every civic right has a corresponding social duty, a practice which develops responsibility on the part of the individual in a democracy, is viewed as a paramount purpose of the nation's schools.

(4) There is an attempt to make civic education functional by relating learning experiences to everyday life in the school and community; book learning is held to be not enough—democracy is made real by giving children the opportunity to participate in planning, and to share in purposeful projects; and by cooperating in practical, civic activities with other community institutions.

(5) It is being realized that the modern world demands citizens who understand peoples and cultures in every part of the earth; youth of the United States need to appreciate better the role of the American system in the international scene, and to gain such knowledge they need to study other governments and varying economic systems, other societies, past and present, with their geographic bases, and the relationship between man and his environment.

(6) There is a growing concern to build programs which will help youth to appreciate the primacy of satisfying human relationships in the affairs of man; courses attempt to point up the import of better group relations, minority rights, social democracy, and of deeper insights into the beliefs of people of other races, creeds, and nationalities.

(7) Current issues are being made an ever more frequent point of departure and source of subject matter; it is held that pupils should be educated to think through problems, to discuss controversial current affairs and arrive at judicious decisions and agreements through a rational approach to the resolution of such issues—youth people who can communicate effectively are more liable to reach consensus of opinion and satisfactory joint action.

(8) Numerous lessons and units are planned to aid the pupils achieve healthy emotional adjustment; students are being aided by the study of personal development, home and family life, boy-girl relationships, and vocational potentialities, as social psychology and mental hygiene are being added to the usual social studies as basic disciplines in civic education.

The developments and conclusions outlined above are the result of intense interest on the part of educators, parents, and community organizations in the welfare of our nation and its youth. Two world wars, the great depression, and an era of quasi-conflict highlighted by a frightening atomic arms race brought these persons together into what developed as a nationwide citizenship movement. The future seemed anything but secure and the schools, as the one common instrument of social education, were envisioned as the prime means of developing youth who share similar values and who would act individually and in concert to maintain what has been great and good in the American past and to assure continued democratic progress.

Experiments in citizenship education marked the decade following World War II. Conducted under varying conditions, these studies attempted to explore different approaches and to help chart the means toward increasingly effective combinations for civic education. A five-year study in Detroit enabled teachers and pupils to organize total-school programs of citizenship education. Kansas, Nebraska, and Illinois are examples of states which initiated statewide civic education curricular studies. Syracuse University sponsored an annual survey of the characteristics of leading "good citizens" in the high schools of New York. Investigations in classroom organization and procedure for citizenship education were conducted by such institutions of higher learning as Stanford and Miami universities. State departments of education fostered numerous projects in the area. Yearbooks of influential national societies (National Council for the Social Studies, *Education for Democratic Citizenship*, 1951; American Association of School Administrators, *Education for American Citizenship*, 1954) reflected reports appearing in professional journals and popular magazines. Pamphlets, teaching aids, and units were sponsored by a host of such diverse groups as the National Association of Manufacturers, the American Legion, the Civic Education Project of Cambridge, and the National Education Association. In 1954 the Citizenship Education Project, sponsored by Columbia University Teachers College and the Carnegie Fund, had involved about 1,500 secondary schools throughout the United States

in developing citizenship education practices in school and community.

All this activity resulted in the exchange of many fruitful ideas for furthering citizenship education in America. Much of the work had not in 1954 as yet crystallized, and current publications and conference topics revealed that enthusiasm had not abated. Many results seem to substantiate what educational reformers have been claiming for years: traditional subject matter presented by traditional method alone holds little promise of enabling students to better attain the aims of American citizenship education. The Detroit Citizenship Study pointed out to those interested in necessary further research that the attitudes and understandings of democratic citizenship are acquired as the result of a many-sided process. The director cautioned, that until more knowledge is gained, the schools should maintain a balanced relationship among the techniques of teaching democracy. The Detroit study did find a genesis for such knowledge and values in four approaches; the attributes of democratic citizenship were found to be learned via emotional appeals, by the intellectual process, through participation in democratic activities, and as the products of emotionally balanced individuals. The importance of a broad program of citizenship education, featuring cooperation between home, school, and other institutions, and which allows for significant pupil action, was also evidenced by a number of the studies. The application of such findings gave promise in 1954 of continually improved education for democratic citizenship in the United States. See ALIEN; ALLEGIANCE; NATIONALITY; NATURALIZATION; NATURALIZATION LAWS; UNITED STATES—*Legislative and Executive Control* (Voting Qualifications).

RICHARD E. GROSS,
Specialist in Social Studies Education, Florida State University.

CITLALTEPETL, peak, Mexico. See ORIZABA.

CITRIC ACID, a naturally occurring crystalline acid, found in most common fruits, particularly lemons, has the formula, $C_6H_8(OH)(CO_2H)_2$. It has a specific gravity of 1.542, a melting point of $153^\circ C.$, and decomposes at $175^\circ C.$ For many years this acid was made by neutralizing concentrated lemon juice with lime, the free acid being liberated from calcium citrate by sulphuric acid. A fermentation process in which molasses is employed along with various molds yields the acid at about one fourth the price of the lemon-juice method. Citric acid is used in preserving fish, coloring vegetables, and in manufacturing carbonated beverages, jams, and pastries. It is important in the manufacture of mirrors, in engraving, dyeing and calico printing. Its salts enter into the blue-print and certain phases of pharmaceutical industries.

CITRON, a tree (*Citrus medica*) related to the lemon, with a large lemonlike fruit having a thick peel and a small amount of very acid pulp. It is grown chiefly in the Mediterranean regions and large amounts of the fruit are preserved in brine and shipped to the United States, where the peel is candied and used for confectionery and culinary purposes. The trees are grown to a small extent in southern Cali-

fornia. The name citron is also applied to a small variety of the watermelon which is used for preserving.

CITRON MELON. See **MELONS**.

CITRONELLA OIL, an aromatic oil obtained from a kind of grass (*Cymbopogon nardus*), cultivated at Singapore and in Ceylon. It is used for scenting soaps and perfumes, and is applied externally to ward off mosquitoes. Other species of the same genus and some other allied genera also yield essential oils.

CITRONELLE, town, Alabama, in Mobile County, altitude 330 feet, on the Mobile and Ohio Railroad, 33 miles northwest of Mobile. Here on May 4, 1865, the last Confederate Army east of the Mississippi surrendered. Pop. (1940) 1,057; (1950) 1,350.

CITRUS FRUITS as pertaining to common commercial species of the genus *citrus* (family Rutaceae) are trees with dense evergreen foliage which vary in height from fifteen to forty feet at maturity. Leaves are usually a dark, glossy green, although the depth of color varies among the species and with soil fertility. The flowers produced in great profusion give off an exotic fragrance which permeates the countryside during the main blooming period. Flowers are mostly white, although some show tints of red. They are small, rarely with more than one or one and one-half inch spread. Blooms may occur more than once a year, resulting in fruit of varying degrees of maturity on the tree at any one time. The regular bloom from some species commonly occurs when a mature crop is still on the tree. The fruits vary in shape from round to oblong, oblate, elliptical, and in size of from one to eight inches in diameter and length. Yellow and orange are the predominant fruit colors, although variations from light lemon yellow to reddish brown are common. The well-known commercial species are oranges, grapefruit, tangerines, lemons, and limes.

These fruits, which have been cultivated for thousands of years, are native to the tropical and subtropical areas of southeastern Asia. From there they were spread to Asia Minor and the Mediterranean region of Europe. Such fruits as lemons and sweet oranges were first reported in European literature about 1400 A.D. Columbus on his second voyage (1493-1496) is believed to have planted the first citrus seed in the Western Hemisphere. This was on the island of Haiti. From there, and from seeds brought from Europe by later explorers, citrus was spread throughout much of the Caribbean region and into Florida by 1565. Introduction into Arizona is believed to have occurred around 1707 and in California in 1769.

Climatic requirements for citrus fruits limit production areas to within thirty-five degrees of the equator, although this may vary by several degrees depending upon bodies of warm water, ocean currents, and elevation. While limited to tropical and subtropical areas, citrus fruit trees do best in subtropical areas and even near the latitudinal limits thereof. Since much of the world's desert area is within this zone the available area for optimum citrus fruit culture is limited. Perhaps this is well for, even with a relatively limited physical area, production occa-

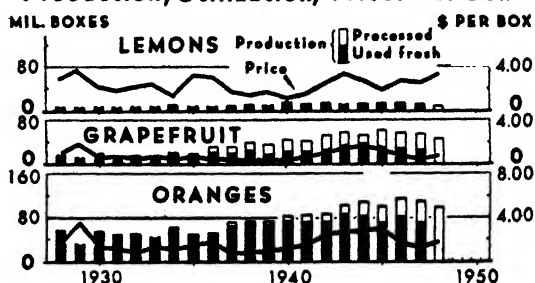
sionally exceeds available commercial outlets.

Within any area of general adaptation the location of a citrus grove is determined primarily by the minimum temperatures which may prevail. This assumes that soil and other physical properties of the location are suitable. Temperatures may vary widely within small distances because of air drainage, elevation, and proximity to bodies of water. In general, a location which is frequented with temperatures as low as 28°F. for a period of several hours duration places too great a hazard for commercial production of the hardy orange and grapefruit species, and especially so for lemons and limes. At such temperatures trees as well as fruit are damaged. The extent of tree damage will vary by species, by age of tree, amount of succulent growth, and the general nutritional level of the tree. Ironically, it is near this margin of success or failure because of cold that the finest quality citrus fruit is generally produced. Heating groves during short or relatively severe periods of cold is common in some of the most productive citrus fruit areas.

Within the limitation set by climate and other physical factors and further conditioned by economic and other human influences, well defined areas of commercial citrus production have developed. The most important are in the United States, around the Mediterranean, the subtropical area of eastern South America, Japan, southeastern Asia, South Africa, and Australia. The United States is by far the leading producing country accounting for 56 per cent of an estimated world production of 343,950,000 boxes in 1946. The average weight of boxes varies; that of oranges being 70 pounds, grapefruit 80 pounds and lemons 76 pounds. Brazil was next in importance in 1946 followed closely by Spain and Italy.

CITRUS FRUITS

Production, Utilization, Prices Per Box *



Courtesy U.S. Department of Agriculture

* Season average returns per box to growers, at the packing house door.

The proportion of the production of the various citrus fruits varies among countries. For example, in 1946 the United States produced 47 per cent of the world's oranges, 62 per cent of the lemons, and 94 per cent of the world's grapefruit; whereas Brazil, the second largest citrus-producing country, limited its production to oranges, which equaled 11 per cent of the world's orange output. In 1946 Italy contributed 27 per cent of the world's lemon and 5 per cent of the world's orange production. Near-by Spain produced 7 per cent of the world's orange crop and only 6 per cent of the lemons.

Though the history of the spread of citrus fruits reads as a romance, the story of the re-

cent expansion in production of this delectable fruit and its products is nothing short of spectacular. From 1920 until 1946 the world production of citrus almost tripled. Much of this increase occurred in the United States where the production of oranges in the same period increased from 25 to 110 million and grapefruit from 6 to 60 million boxes. No other crop in the United States of comparable commercial importance, save soybeans, expanded so rapidly during the period indicated.

Such an expansion in production had to be accompanied by corresponding increases in consumption, which in the United States increased from 18 pounds per capita in 1910 to 92 pounds in 1947. The factors mainly responsible for this increase include improved and more rapid transportation and distribution facilities, emphasis on the nutritional value of citrus fruits, aggressive advertising and merchandising, and the development of the citrus canning and processing industry which permits of wider distribution both as to time and area.

The production of citrus fruit in the United States, which reached 192,000,000 boxes in 1947, is concentrated in the states of Arizona, California, Florida, Louisiana, and the southernmost part of Texas. Small quantities are grown locally in coastal areas of Alabama, Mississippi, and Georgia. More than 90 per cent of the United States orange crop is produced in California and Florida. Florida and Texas account for more than 85 per cent of the grapefruit production. Practically all of the commercial lemons are produced in California; whereas Florida produces the bulk of the lime crop with small quantities produced in Texas and California.

Citrus fruits are one of the best sources of vitamin C and, in addition, contain vitamin A, thiamine, riboflavin, and niacin. At maturity they are usually well colored, full of juice, and the acid and sugar content together with other constituents of the juice is such as to give a delicious flavor. Unlike many other fruits, citrus, on attaining maturity, can remain on the tree for weeks and with some species for months without becoming over-ripe or over-mature. Again, unlike certain other fruits there is no further ripening process after harvesting, other than for changes in skin color. At certain times of the season, and varying with weather conditions, citrus fruit may attain full maturity without the desired degree of skin color. To overcome this condition, oranges, grapefruit, and tangerines are placed in coloring rooms immediately after harvesting. There, under controlled temperature and humidity, ethylene gas is released for a given period of time. This process hastens the natural coloring of the fruit. Lemons, unlike other citrus fruits are picked at varying stages of coloration, varying from dark green to yellow. Those with green stages of coloration are "cured" before shipment, in rooms with controlled humidity and temperature (50° to 60°F.). Under such conditions they are held from several weeks to six months.

The harvesting, packing, and processing of citrus fruits is highly organized and mechanized. Packing and canning plants provide crews and equipment for picking and hauling to the plant. On arrival at the fresh fruit packing house, fruit is treated to bring out the color if needed. It is then washed, treated to retard decay,

waxed to reduce shrinkage and improve appearance, sized, graded, sometimes wrapped, and packed in boxes or bags. Each of these operations is mechanized, except for grading and place packing in boxes. After packing, the fruit is often precooled, depending on the season of the year, and loaded and shipped mainly in refrigerated cars, either to keep temperatures down or to protect against freezing. For near-by and even more distant markets significant quantities are shipped in ventilated cars and trucks.

Since techniques were developed and improved in the 1920's and 1930's for canning citrus juices and sections, a rapid expansion has occurred in the amount of fruit processed. In the 1946-1947 season 28 per cent of the United States orange and 45 per cent of the grapefruit crop was processed. Oranges are processed into single-strength juice and concentrated juice, while the principal processing of grapefruit is confined to single-strength juice and canned sections. Important quantities of blended orange and grapefruit juice are canned.

The canning of citrus fruit juices is even more highly mechanized than in handling fresh fruit for market. Fruit is accumulated in large bins from whence it is moved to the canning plant. It is thoroughly washed en route to insure clean and bacteria free fruit at the time of juicing. Juice extraction is entirely mechanized. The juice is accumulated in large tanks for proper blending to insure optimum quality. It then is flash pasteurized, canned under vacuum, labeled, and the cans are placed in cardboard shipping cases. In the manufacture of citrus juice concentrate, water is removed from the juice by "boiling" under vacuum. Temperatures which need not exceed 55°F. are kept to a minimum to protect natural fruit flavors. After concentration to the desired level, canning proceeds in the same fashion as for single-strength juice. Since World War II an increasing proportion of orange juice concentrate with three parts of the water removed is being frozen. This product, when reconstituted by adding the amount of water removed in processing approaches, if not equals, freshly squeezed orange juice. By-products from citrus fruit processing include pectin, citric acid, orange and lemon peel oils, seed oil, citrus molasses and stock feed.

Citrus fruit producers in the United States market their fruit in various ways. Growers may sell their fruit for cash on the tree for harvesting and marketing by the purchaser. Many are members of cooperative marketing organizations which perform all marketing services. Still others have their fruit harvested and marketed for their account, while a few harvest and provide their own packing and marketing facilities. Citrus fruits for fresh consumption reach the consumer through several channels. Sales to wholesalers and distributors may be made at the shipping point, or on delivery at the terminal markets, through terminal auction markets, or by consignment to commission merchants. Retailers may obtain their supplies directly at auctions, but more generally deal with wholesalers and jobbers. Large-scale chain store organizations often buy directly at the country shipping point. Canned citrus juice is distributed through brokers and wholesale grocers, although large retail organizations, as in the case of fresh fruit, commonly buy direct from processors.

In addition to the domestic market for citrus fruit, United States producers, along with producers in other parts of the world, look to export markets to dispose of a portion of their output. Export outlets are of relatively greater importance to producers in Spain, Palestine, Italy, and South Africa than for United States producers. The principal foreign market for United States citrus fruit is Canada. Because of its proximity and the availability of through rail transportation, the Canadian market is almost considered in the same category as the domestic market. Other important foreign markets for United States citrus fruit, prior to World War II, were the United Kingdom, France, and other northern European countries.

The commercial importance which the citrus industry attained by 1948 basically rests upon the palatability and health qualities of citrus fruit and their products which have made them so universally acceptable to all consumers. Knowledge that adequate quantities of vitamin C in the daily diet is essential to good health, together with the widespread knowledge that citrus fruit is one of the richest sources of this vitamin, and that it contains other important vitamins and minerals as well, has been a powerful force in directing consumers to the regular use of citrus. This factor, combined with reasonable prices and the universal taste appeal of citrus fruit, has progressively provided additional outlets for this crop.

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FLOYD F. HEDLUND,
United States Department of Agriculture.

CITTA VECCHIA, chêt-tā' vĕk'kyā, or **CITTA NOTABILE**, a fortified city of Malta, formerly the capital, near the center and almost on the highest point of the island, seven miles west of Valletta, which became the capital in 1570. The city was severely bombed by Italian and German aircraft during World War II. Pop. (1931) 22,182.

CITTADELLA, chêt-tā'dĕll'ā, Italy, city in Province of Padua, compartimento of Venetia, 30 miles northwest of Venice. It contains beautiful churches and botanical gardens. Its modern industries are the manufacture of paper, cotton, woolen goods and linen. It was founded in 1220, as a protection against Treviso, and has still retained its walls, tower and moat. Pop. (1936) town 4,588; commune 12,966.

CITY. The term "city" has various meanings. To the student of Greek and Roman history it means not only the walled town of Athens or Rome but the territory surrounding it, in the latter case very widespread, the inhabitants of which enjoyed the privileges of citizenship; in other words, a city-state. In England, the term still is used sometimes to designate a borough which is also the capital of a bishop's see, a carry-over from a now archaic ecclesiastical terminology. In the United States, a city is, in legal language, a particular type or class of municipal corporation. As commonly used, however, city merely means a relatively dense aggregation of population of considerable size, in which the conditions of life can be described as urban in contrast with the rural life of the open country.

It is in this broad popular sense, that the word city is used in this article. In that sense cities are a universal phenomenon of civilized society. They are found in every country which has advanced beyond a pastoral economy, a large number, indeed, in countries like India and China which have been only slightly touched by modern industrial progress.

It is impossible to draw an accurate line as to where country leaves off and city begins. No specific population or degree of density can be set down as necessary to constitute a city. The United States census bureau for statistical purposes classes all municipalities with over 2,500 population as urban. Many places of 2,500, however, are obviously rural. Since some kind of mathematical definition seems desirable for purposes of clarity, the reader may assume that when this article speaks of cities it means compactly built-up communities of at least 5,000 people.

Cities had their beginnings in the need of naturally gregarious mankind to seek safety and mutual protection in some easily defensible location. The inaccessible rock of the Acropolis determined the site of Athens. Rome owed its start to its seven hills surrounded by the marshes of the Tiber. The defense motive alone, however, would never have produced cities of any size. It was the development of trades and crafts behind the protection of the city walls, and the exchange of their products for food and raw materials, on which city growth was fed. Naturally, the earliest large cities were found in the Nile and Tigris-Euphrates valleys where easily navigable streams enabled this exchange of goods to take place over a wide and fertile area. Thus, thousands of years ago, the main forces which have produced cities in later times, that is, industry, commerce, transportation and markets, were manifest in Babylon, Nineveh, Memphis and Thebes.

In primitive times, accessibility to water transportation was of the first importance to city growth. It was not by accident that the famous cities of classical antiquity were to be found mostly dotting the shores of the Mediterranean. In modern times, railways, highways and airways have usurped to considerable degree the place of water transportation in determining the sites and size of cities. Several of the world's greatest cities—Moscow, Berlin, and Paris, for example—are now located far from the sea, with only minor streams and canals to serve them. There can be no doubt, however, that the great ports of London and New York have played a major part in putting them at the top of the roll of cities. The places where land and water or ocean and river transportation meet are places where merchants thrive. Commerce, the exchange of goods, is an important supplement to industry, the production of goods, in building up the wealth and population of cities. Of the twelve largest cities in the United States, six—New York, Philadelphia, Los Angeles, Baltimore, Boston, and San Francisco—are ocean ports. Three more—Chicago, Detroit, and Cleveland—are important Great Lakes ports, while St. Louis, Pittsburgh, and Washington are located on navigable rivers. This circumstance has had little to do with the growth of Washington but it had much to do with the early prosperity of St. Louis and Pittsburgh and is still a factor in their commercial life.

There are other causes which contribute to the growth of cities. Some have gained importance as centers of religious devotion—Rome and Jerusalem being striking examples. Others have profited from their reputations as centers of learning or art. Paris for centuries has drawn students from all parts of the world to its ateliers and universities, and tourists by the thousands to its galleries and museums. Climate has been a powerful lure in drawing population to such famous centers as Nice, Miami, and Los Angeles. By far the most important of these noneconomic factors is government. Imperial Rome produced almost nothing but government which it exchanged for tribute from its far-flung provinces. In recent times, the growing tendency to centralize the rapidly increasing activities of government in national capitals has had much to do with the swollen proportions of London, Berlin, Paris, Washington, and Moscow. Into these vortices of power and administration are drawn not merely the agents of government but those who seek its services and favors. Particularly striking has been the growth of Washington which in 1900 had only 278,718 inhabitants and rose to 663,091 in 1940. Since that time its growth has gone on more rapidly than ever, its reflection in the census tables depending on how much of this increase has spilled over into adjacent Maryland and Virginia.

Though the life and achievements of cities stand out preeminently in the earliest pages of recorded history, it has only been in the 20th century that they have assumed the character and proportions with which we are now familiar. The cities of the ancient world were mostly small, densely populated areas surrounded by defensive walls. Politically these centers were completely identified with the surrounding country which formed an integral part of the city-state. The truly urban area within the walls, judged by modern standards, was very limited in extent and population. These ancient cities looked large to contemporary writers and they brought down to our day an exaggerated impression of city size. Exact figures as to the population of ancient cities are not available but the estimates of scholars put the population of Athens at the height of her glory at from 40,000 to 140,000, Jerusalem at 30,000, and Carthage—one of the largest of the Phoenician cities—at not more than 300,000. Rome in the Augustan era, generally agreed to have been the largest city of that time, is best estimated at not more than 800,000, and many modern scholars put its population at a smaller figure. Indeed, providing for 800,000 people in a city without any artificial means of passenger transportation except the chariots and litters of the rich was not the least of the marvels of the capital of the world.

Following the barbarian invasions of the 4th century cities practically disappeared from western Europe. They did not all go at once. Some were destroyed by the invading hordes who had no use for cities except to pillage them. They would probably have sprung to life as have the cities battered in World War II had it not been that trade routes were broken and that the simple agricultural economy and rigidly formal social organization of feudalism left cities to wither on the vine. A few Mediterranean ports continued some shadow of urban

life on the basis of trade with the East. Rome was a long time reaching its low point of 17,000 population about the end of the "Babylonish Captivity" in 1377, but most cities died more promptly. Constantinople, at the extreme eastern limit of Europe, was the only European city to go through the Dark Ages with a population of 100,000.

The rebirth of cities began with the revival of trade in the 10th century. Slowly at first, and then with increasing rapidity, the famous cities of medieval Europe rose. The city republics of Italy, the Hanse cities of Germany, the flourishing cities of the Low Countries, in the course of a few centuries played once more a major role in history. They threw off the shackles of feudalism and gave birth to modern systems of law and justice. They contended in the field with armies of kings and princes. They developed a life so rich and pleasant as to cause some writers to look back to the 12th and 13th as the best of centuries. They were, however, of no great size compared with the modern metropolis. At the beginning of the 16th century there were but six European cities with more than 100,000 population—Constantinople, Paris, Naples, Venice, Milan, and Lisbon. Ghent at that time boasted 50,000 people, London, and Bruges 40,000, and Brussels, Louvain and Liege 20,000 to 30,000 each.

With the discovery of America a new era in the growth of cities began. World trade replaced local trade. Cities which could exchange their manufactured goods for the food and raw materials of distant continents had almost no limits to their growth. The die was cast for this revolution when the ships of the early navigators began nosing their way into the bays and rivers of the New World. As time has gone on the ships have become larger and faster. Steam has replaced sail, and the turbine the reciprocating engine. The impetus given city growth by Columbus' successful voyage never relaxed its force until the New World became an old world with a mature economy of its own and no more physical frontiers to conquer. In other words, from 1492 to 1914 world trade exercised a continuing and constantly accelerating influence on city growth. Repeated world wars and nationalistic policies of trade restriction have hampered and obstructed for a generation the free exchange of goods on a world-wide basis but without causing any shrinkage in the size of cities.

Other influences, of course, have combined with worldwide trade to cause the extraordinary growth of modern cities, some of which are as powerfully operative as ever. One is a marvelous development beginning early in the 19th century of the means of land transportation. This has made cities like New York and London a physical possibility by enabling the worker to live far from his work, his amusements and his shopping center, as well as providing a network of agencies for the movement of goods to and from cities. Land transportation has now been supplemented by air transportation but what effect it will have on city growth is as yet problematical. A second force has been the vastly increased productivity of labor in industry. Beginning with the industrial revolution, machines driven at first by water, then by steam, and finally by electricity, have replaced old-time hand labor. Machine production means, in fact,

city production, as large-scale industry when not originally located in a city quickly builds up a city around it. The third force has been one of equal importance but one frequently ignored in popular discussions of the subject of city growth—the agricultural revolution. This has been no less significant than the industrial revolution. This will be clearly realized when it is remembered that the modern plow did not come into general use until well into the 19th century; that, up to that time, corn was planted by hand and covered with a hoe; that such cultivation as a growing crop received was by the application of muscle to a hoe handle; that hay and grain were cut with a scythe and raked by hand while grain was threshed on the barn floor with a flail as in Biblical days. Modern agricultural machinery, not to mention improved breeding of animals and more productive trees and plants, enable a much smaller proportion of the world's population to supply the food for city people than 150 years ago. All of these forces are still operating, and, while the rate of city growth has slackened in recent years, cities are still growing and the proportion of city dwellers to country folk is steadily increasing.

Cities of 100,000 population are now scattered broadcast over the world, 92 in the United States, 224 in Europe, and 248 in the rest of the world. Of these 564 cities, 33—5 in the United States, 15 in Europe and 13 in the rest of the world—had more than a million inhabitants prior to World War II. City life indeed has become the characteristic form of existence for a majority of the people of the United States and western Europe. In 1931 the percentage of the population living in places of 5,000 or more was 77.3 in England, 69.5 in Scotland, 56.4 in Germany, 45.5 in France, 78.8 in Holland, 60.4 in Belgium, 69.7 in Italy and 52.2 in the United States. In the United States the percentage rose only slightly, to 52.7 in 1940, reflecting a movement away from the cities during the depression years. The intense industrial activity during World War II and after apparently has reestablished the trend from country to city. Authentic figures as to the proportion of urban to rural population are not available for most other countries, but from the number of great cities which are to be found everywhere outside the equatorial jungles and polar icecaps it is clear that the dominant position of the city is a worldwide phenomenon. We sometimes call this the age of steel, the age of electricity or the age of the automobile. It certainly can be called, as no other period could, the age of the city.

The history of these cities, whose growth from primitive antiquity to the present day this article has traced hurriedly has been the history of civilization itself. In the beginning they furnished the first opportunity for extensive division of labor and opened the door to invention and industrial progress. They suffered an eclipse in the Dark Ages, but the few which contrived to exist kept alive the traditions of ancient skills, and in the 10th century civilization once more started its upward spiral from the little cities which sprang up at the foot of a castle just outside the precincts of an abbey or at the head of navigation of some stream. From that day to this leadership in industry, commerce, art, and literature has been found in the

cities. Many individual leaders, it is true, have been country-born and bred, but almost without exception it has been the city which has supplied the inspiration and opportunity for their genius.

These are facts which it is well to remember, when pessimists decry the city's influence on its people and deny its capacity for self-government. This negative attitude of mind has been reflected in the United States in the general gerrymandering of legislative districts to permit the farms and small towns to dominate the cities. There is no denying that cities from the earliest times often have been turbulent, revolutionary, and corruptly governed. American city government was labeled in 1888 by James Bryce in his *American Commonwealth* as the "one conspicuous failure of the United States." That label has stuck though it no longer represents the truth about American cities. American city government was at a low ebb in 1888 but it has since been transformed not by the efforts of rural reformers but by the people of the cities themselves into what may properly be called the one conspicuous political success of 20th century United States.

Cities early developed democratic means of meeting the problems which faced them. They have sometimes succumbed to tyrants and bosses from within, or to the centralizing tendencies of kings and dictators from without. The career of the cities has been a chequered one as has been the history of every human institution. Yet there are no more glorious pages in the story of the struggle for popular self-government than those which were written by the Italian city republics of the early Middle Ages, the Flemish cities of the 12th century, the Boston town meeting in its controversy with the British crown, or the people of Cincinnati when they threw out a boss and wrote themselves a new and admirable form of government in 1924.

Cities have repeatedly demonstrated their capacity, when released from the leading strings of centralized government, to handle their own affairs. There is no reliable evidence to show that man cannot successfully adjust himself to the conditions of city life without either physical or moral deterioration. Even the bad effects of city slums can be overcome by health, recreational, and educational programs now under way in most cities. Cities, historically speaking, have had a sort of compactness and unity which has enabled them to grapple vigorously with crises. Means of communication by press, radio, and the mouth-to-ear contacts by which news travels faster even than over wires or through the atmosphere have always been and still are more effective in the city than in the country. The greatest internal handicap under which American cities have suffered has been the great diversity in race and language in their populations. Integrated public opinion is difficult to secure among racial and language groups whose backgrounds differ widely and to whom demagogic appeals of a racial character are most effective. This condition, however, is gradually correcting itself under present immigration laws.

In the meantime, however, a new difficulty confronts the great urban communities in dealing with their complex problems. This arises from the tendency of urban population to overrun legal city boundaries. Where the political city and the economic and social city no longer coincide, it is difficult to secure coherent and effective

action. This condition exists in all great centers of population and has nowhere been more than partially solved by annexation or consolidation. In fact, the outlying units of government over which the population of a modern metropolis sprawls generally are adamant in their resistance to absorption by the central city. How serious this problem has become is apparent from the fact that New York's metropolitan area extends into three states, Chicago's into two states, and Detroit's into two countries. That it is growing more and more intense appears from the United States census returns for 1930 and 1940 which show the nucleus cities of Philadelphia, Boston, Pittsburgh, San Francisco, St. Louis, and Cleveland actually declining in population while the portion of their metropolitan areas lying outside the nucleus city increased substantially. The causes of this outward movement of population are the obsolescence of homes in the close-in section of the nucleus cities and the gradual deterioration of old residential neighborhoods, plus the facility afforded by the automobile of living miles away from one's work. The results are the spread of blight and slums in the nucleus cities, and a serious threat to their financial soundness. Worst of all, however, is the inability of a metropolitan region, made up of dozens or even hundreds of independent local governments, to devise means of meeting its common problems.

THOMAS HARRISON REED.

CITY APPROPRIATIONS. See APPROPRIATIONS, AMERICAN SYSTEM OF; BUDGETS, AMERICAN.

CITY BUDGETS. See BUDGETS, AMERICAN; APPROPRIATIONS, AMERICAN SYSTEM OF.

CITY COUNCILS, American. In all American cities there is a city council which can properly be called the governing or policy-determining body of the city. It adopts ordinances not only regulating the conduct of the public, the use of the streets and such matters, in the interest of the public peace, health, and safety, but creating positions, fixing salaries, making appropriations, and authorizing or proposing bond issues. In it are ordinarily vested all the powers and duties of the city government which are not specifically given by the city charter or the laws of the state to some other officer or agency of the city.

The organization of the council, its legal powers, and its relative weight in the city government, however, differ widely as between the types of city government found in the United States. These are: (1) the independent executive type which is again divided into two subtypes, the strong-mayor and weak-mayor plans; (2) the commission plan; and (3) the manager plan. (See MUNICIPAL GOVERNMENT, AMERICAN.)

City Council Under Strong-mayor Plan.—The council is at its weakest in the strong-mayor cities which are few in number but which include cities like New York, Boston, Detroit, St. Louis, and Indianapolis. The council in such cities is reduced to purely legislative functions. It still makes regulatory ordinances and grants franchises. Its consent is necessary to confirm bond issues and to make appropriations. In the field of regulatory ordinances,

however, the only one in which it preserves much initiative, it is subject to the mayor's veto. In the matter of appropriations it can act only on the recommendation of the mayor. It cannot add anything to his budget or other financial proposals. It can only reduce or reject them. This means that the mayor holds the whip hand in matters of finance. Since most municipal activities involve the spending of money the strong mayor is the chief force in determining policy as well as in directing administration. Moreover, the council in these cities does not have that share in the administration which comes from the power to confirm the mayor's appointments. Of course, the council is in a position to hamper the mayor and his executive subordinates by cutting down or rejecting appropriations, and to embarrass them by publicizing what its members conceive to be the delinquencies of the city administration. These, however, are at best negative powers, and, in fact, are so feeble as to lead to the jesting remark that in strong-mayor cities there is not much to do with the council but to put it out of pain.

New York, the largest of the strong-mayor cities, has in effect a two-chamber city council since the mayor's budget goes first to the board of estimate and apportionment and much other important city legislation requires the approval of that body as well as of the council. The board of estimate and apportionment is made up, with one exception, of administrative officials—the mayor, comptroller, president of the board of alderman, and the five borough presidents. Its presence tends to still further submerge the council. The New York Council was for some years elected by proportional representation but as the result of a referendum in the fall of 1947, New York hereafter will elect its councilmen by districts.

In other strong-mayor cities the organization of the council, methods of election, terms and salaries of councilmen are much the same as in weak-mayor cities.

Council Under Weak-mayor Plan.—Cities under this plan, which prevails in about 1,200 cities of over 5,000 population, have councils of varying degrees of authority. In many such cities the council is free from any mayoral veto of its decisions. Mayors in some cities gain some influence by being ex officio the presiding officer of the council, but in most of them the council chooses its own president. In all such cities the council either makes up the budget through one of its committees, or the mayor prepares it subject to the power of the council to amend it up or down at will. The council, usually, also has the power of confirming most if not all of the mayor's appointments. Not only does the council have this share in naming the heads of departments and other important officials, some of whom it frequently elects without the mayor's intervention, but its control of the purse makes effective its control of these officials after they are elected. It is usual to have a council committee for each important unit of the city administration, and these committees often hold a tight rein on the department they supervise. It is obvious that under this system, each committee, to a large extent, will be a law unto itself, producing a decentralized and disorganized kind of city administration.

This does not mean that a mayor with a strong political following and a flare for leadership does not sometimes lead a council by the force of his personality. The public frequently looks up to the mayor as its peculiar representative in the city government and his opportunities for publicity are much better than those of councilmen. Some mayors use these opportunities. Generally, however, the council is supreme in a weak-mayor city.

The composition of the council varies from city to city but one description will serve for all cities of the independent executive type whether they are provided with strong- or weak-mayor charters. In addition to New York 13 cities, all in New England, still cling to the two-chamber council. Such councils, in imitation of the state and federal governments, were common in the first half of the 19th century. They have gradually disappeared and are to be regarded as an anachronism even in New England. The largest single-chamber city council is that of Chicago with 60 members. The number runs down to 2 or 3 in some small municipalities. The median for cities of over 500,000—and all such cities have the independent executive type of government in one form or the other—is 19. For all cities of over 5,000 it is only 7. This is in marked contrast to the size of English, French, or other European city councils which are usually large bodies. The principle seems to have been generally accepted in this country that a city council should be a body small enough so that its members can sit around a table and discuss city affairs without making speeches at one another or at the attending citizens. The spread of at large elections has also had a decided effect in keeping down council membership. Cities as large as Detroit and Pittsburgh, which elect their councils at large, have found nine to be a convenient number.

Councilmen in slightly over half of this group of cities are elected for two-year terms and in about 40 per cent of them for four-year terms. Election by wards and election at large are about equally prevalent (37 and 40 per cent respectively). The remainder use a combination of the two methods—usually a majority of the council being chosen by wards.

Candidates for the council are elected under party designations in a majority of cities with the independent executive type of government. A large minority—over 40 per cent of this class of cities—use a nonpartisan ballot. This does not mean necessarily that there is no party activity in city elections. Generally speaking, partisan ballots and intense party activity are the prevailing practice in the northeastern section of the country, while actual nonpartisanship becomes more common the further one goes toward the Pacific coast.

Salaries are paid councilmen in all cities of this class with over 250,000 people. The salaries range from \$1,800 to \$8,000 in those of over 500,000, and from \$600 to \$4,800 in cities of from 250,000 to 500,000. Below this population level there is no salary of more than \$3,500, and the median falls from around \$500 for cities of from 50,000 to 250,000 to \$100 for those of from 5,000 to 10,000. Numerous small cities pay councilmen nothing.

The work of a councilman in a large city is often rather heavy. If he is elected from a ward

he is expected to run errands at city hall for his constituents. He serves on one or more council committees and these committees, of which there usually is one for each important branch of the administration in a weak-mayor city, are in such cities the real directors of administration. There are also many matters, such as street openings, street widenings, and the making of public improvements by special assessment, which require repeated acts by the council or council committees. In a period of public works activity many hours a week may be spent in this way. It is natural that a councilman should expect some compensation for such service. This feeling is sometimes the excuse that is offered for the abuse of the councilman's opportunities for private gain. In small cities the post of councilman is not a laborious one.

Council Under Commission Government.—

The commission form of government, which exists in some 300 cities of over 5,000 population, including such places as Newark, Jersey City, New Orleans, and St. Paul, is council government pure and simple. All the powers of the city are vested in a council, usually of five members, though three are found in some small cities. Its individual members are each the head of one of the departments into which the city administration is divided. In theory, at least, the council is the final authority in administrative, as well as in legislative matters, appointments to all the principal positions being made by it, usually on the recommendation of the commissioner in charge of the department concerned. When budget time approaches each commissioner prepares the estimates of expenditure for his own department. The commissioner in charge of finance puts these and the estimates of revenue together and then the council meets to discuss and adopt the budget. No one member has any more authority in the body than any other. The mayor, who sometimes is elected to that position by the people and sometimes chosen by his colleagues, has no veto. He merely presides over the council and acts as the ceremonial head of the city. He has no more power than the other members of the council, except what he may derive from a certain prestige which attaches to the title of mayor.

Under the commission plan there are no committees unless you choose to regard each commissioner as a committee of one for his department. Obviously, the combination of the duties of working head of a department and those of councilman, including the tedious routine of street openings and assessments, spells work. The commissioners, except in a very few places, receive salaries. The highest paid is \$7,500, while the median in cities of 250,000 to 500,000 is \$6,000, and in cities of 50,000 to 100,000 is still \$3,550. Where substantial salaries are paid, the cost of legislative and executive overhead under the commission plan is greater than for cities of similar size under the independent executive or manager types of government.

Councilmen under the commission plan invariably are elected at large. The term is four years in over 60 per cent of the cases and two years in about 25 per cent. Three quarters of the cities of this class use a nonpartisan ballot.

In some commission-governed cities, the com-

missioners run for specific commissionships. In others, they run for the council either on a general ticket or against designated opponents. Where the assignment of the departments to commissioners is not determined in advance by election they are assigned by vote of the commission. This frequently results in conflict within the commission, and if there are majority and minority elements within it, to an unfair division of patronage and authority.

As a legislative body the commission council operates, except for the absence of committees, in much the same way as do councils under the independent executive type of government. The commission council has a clear advantage in transacting business because of its small size and the intimate knowledge each of its members has of at least some of the details of the city's business. When it comes to the performance of its administrative functions, the commission plan runs into difficulty. The commission as a whole is supposed to be the general executive and to supervise the conduct of its members as heads of departments. In theory, this should produce a body of extraordinary efficiency and there have been instances, as in the early days in Galveston, when such was the case. Success in this direction, however, requires commissioners of a very high type working in such perfect harmony as to be ready to accept suggestions and criticism one from the other. This combination is rarely achieved. (The natural tendency of commissioners is to avoid criticism of one another on the principle of doing unto others as you would have them do unto you, an excellent ethical principle that has obvious limits when applied by members of a body supposed to represent the public interest.) Commission councils tend in most instances to become merely routine bodies which leave everything of an administrative nature to be settled by the individual commissioners as department heads. This leads to a high degree of decentralization in administration in which each department is a little empire by itself. When, however, commissioners disagree, there is apt to ensue a period in which the whole setup is disrupted by captious criticism and bickering which render the commission powerless. At such times, even the common device of executive sessions in which differences are thrashed out fails to preserve the efficiency of the commission as a supervising body.

The manager plan, now in vogue in over 450 cities of over 5,000 population, returns the council to its proper function of a legislative or policy-determining body without depriving it of ultimate control over the administration. Its members are not expected to interfere in the operations of the manager or his department heads. In fact, in some charters they are forbidden to do so. Generally speaking, the council makes few appointments in addition to that of the manager himself. There are no committees except for the study of special subjects. Much of the business to be done is carefully prepared in advance by the manager. The task of being a councilman is less onerous than under other forms of government and more satisfying, since, through the manager the council exercises an effective control over the whole city government. It has therefore been found possible to induce a high grade of citizen to seek election to the council, in spite of the fact

that where councilmen are paid at all, the amount is usually a nominal one. The highest salary paid is \$5,000 in Cincinnati. The median rate of pay is \$1,500 in cities of from 250,000 to 500,000, \$980 in cities of from 100,000 to 250,000, and drops rapidly to \$66 in cities of from 5,000 to 10,000.

The size of the council varies somewhat, the range being from 20 to 2. The most frequent number is 9 in cities of over 100,000, and 5 in other places. The mayor, who is merely a presiding officer and ceremonial head of the city, usually is elected by his colleagues, but in some cities the candidate for council receiving the highest number of votes automatically becomes mayor. Elections in 82 per cent of the manager cities are on the double-election non-partisan plan elsewhere described. Councilmen are elected at large in 72 per cent of the cities with the manager plan. It is sometimes objected that at large election tends to produce a council all of one kind. In some 70 per cent of city manager cities this result is somewhat modified by electing part of the council at one election, and the remainder at the next. The term is usually either two or four years, the former being preferred in 42 and the latter in 44 per cent of all cities of this class. Proportional representation by the Hare or single-transferable-vote plan is in use in a few cities, the most notable of which is Cincinnati. Apart from its other merits which are urged by many students of city government, it is the most practical device for avoiding the one defect of at-large election, that is, getting a council all of one political persuasion. See also MUNICIPAL GOVERNMENT, AMERICAN.

General Character of American City Councils.—No one familiar with the development of American city government over the last half century can fail to recognize the great and fundamental change which has taken place in city councils. Fifty years ago city councils were large bodies—frequently two large bodies—almost invariably elected by wards on a partisan basis, with nominations in the hands of unregulated party caucuses. The result was that American city councils became a byword for incapacity and corruption. It would be too much to say that all city councils today are capable and honest. However, most of them, are so. Decent election and registration laws, regulated primaries where partisan elections continue to be used, and well protected nonpartisan or proportional-representation elections elsewhere have had their effect. Still more important is the more clearly defined responsibility which attaches to the members of smaller bodies, and the higher qualities which are required for election from a city as a whole. With some exceptions, American city councils compare favorably today with similar bodies the world over, not merely for honesty but for the ability and dignity with which they perform their duties.

THOMAS HARRISON REED.

CITY DISTRICTS. See DISTRICT.

CITY MANAGER PLAN OF GOVERNMENT. This form of government for cities, which made its first appearance at Staunton, Virginia, in 1908, and was fairly launched by its adoption by Dayton in 1913, in the succeed-

ing generation has passed well beyond the stage of experiment. By the end of 1948 it was in operation in 856 local communities. Most of these were in the United States, but the plan has invaded Canada, Ireland, and Puerto Rico. It has been adapted to the needs of numerous New England towns, and applied in more than a dozen counties. During this same period only 38 communities have abandoned the manager plan, usually because of the hostility of the local politicians. Not a single year has gone by since 1914 in which the number of cities with the manager plan has not substantially increased and, what is even more significant, its rate of adoption has been greatly accelerated in recent years. There were 76 adoptions in 1946, 79 in 1948, and 77 in 1949, a total of 232 in three years. This is impressive when it is considered that the average annual rate of growth for the 26 years from 1914 to 1940 scarcely exceeded 20. This continued and accelerated popularity indicates that the manager plan is here to stay.

The place occupied by the manager plan in American city government is indicated by the following table derived from the International City Managers Association's *Municipal Year Book* for 1948:

Population group	Number of cities in group	Number with manager plan	Per cent with manager plan
5,000-10,000....	962	157	16.3
10,000-25,000....	662	150	22.7
25,000-50,000....	212	58	27.3
50,000-100,000....	106	32	30.2
100,000 & over....	92	20	22.8
All cities of over 5,000.....	2,034	417	20.5

It is especially significant that the conquests of the manager plan have been relatively more extensive in cities of substantial size than in the small semirural communities. The manager plan has grown at the expense both of the independent executive type of city government and the commission plan. The steady increase, however, in the number of small municipalities in which the weak-mayor subtype is predominant keeps that form of government numerically about where it was in 1920. The commission plan has lost ground steadily, there being, at the close of 1948, scarcely 300 cities of over 5,000 population with that form of government. It will be remembered that the Des Moines plan, a commission government on the Galveston model, with the initiative, referendum, recall, and nonpartisan majority elections added, swept the country in the ensuing years. It is a point worth noting, therefore, that Des Moines, by vote of her people, abandoned the commission for the manager plan in the spring of 1949. Among the cities adopting the city manager plan in 1947 were those conservative state capitals, Hartford, Conn., and Richmond, Va., the latter making the jump directly from a two-chamber council.

The reasons for the success of the city manager plan of government are not hard to find. It provides for the government of a city the simplest and most effective form of organization the organizing genius of America has produced—a board of directors to make policies and a

professional executive to carry them out. This is the form of organization familiar in the private business corporation and also in the management of universities and other public institutions. The city council is of board-of-director size, nine being the prevailing number in cities of over 100,000 and five in smaller places. In better than 72 per cent of cities with the manager plan, it is elected at large to ensure a broad-gauge city-wide point of view in its deliberations. In 82 per cent of cities with the manager plan it is elected on a nonpartisan ballot. This does not exclude politics from council elections but it does give the independent voter a chance and keeps the party leaders on the alert.

The council so elected chooses the manager who serves at its pleasure and to whom is entrusted the entire task of administration. From his knowledge of the needs of the city he suggests policies to the council which it usually adopts, but the decisions are its decisions and not the manager's. Whatever the council decides the manager loyally carries out so long as their mutual confidence continues. When he ceases to have the confidence of the council or the council overrides him on matters he considers vital there is a new manager. When the manager plan is proposed in a new city, the cry is often raised that the city manager will be a dictator. That is untrue. The center of the manager plan is not the manager but the council. The manager has broad powers but they are held at the will of the council, and he is constantly under its supervision and control.

The city manager is generally a professional official in the same sense as is the superintendent of schools. Most charters and state optional acts providing for the city manager plan contain a special provision that the manager need not at the time of his appointment be a resident of the city or state. The practice of appointing "outsiders" is common and increasing. Many of the earlier city managers were engineers, and in small cities which carry on public utility enterprises, there is still something of a premium on engineering training as a qualification for the managership. Today, a city of any size looking for a city manager has a number of managers with previous experience in other cities to choose from. The city managers have a well staffed professional association—the International City Managers Association. It has evolved a code of ethics and publishes annually, a most useful compendium of information concerning municipalities of all types in the United States, the *Municipal Year Book*. Fortunately the salaries paid managers—\$15,000 to \$25,000 salaries are now common—have been high enough to attract the attention of ambitious young men toward the managership as a profession. Several universities now offer graduate curricula in public administration, one of the chief activities of which is training men for city managerships. Coupled with the numerous opportunities for "internship" in city government, the supply of manager material is thus constantly being supplemented by young men with excellent academic backgrounds.

In the early years of the city manager plan the turnover among managers was startling. The statistics of the *Municipal Year Book* have shown a steady improvement, and the job can now be regarded as being as stable, as any pub-

lic position not protected by civil service can be expected to be. Many men have now had long and successful careers as managers in a succession of cities. A few have spent their active lifetime chiefly in one city. It would be too much to say that politics does not enter into the appointment of managers in some cities, especially when the choice is a local man, but, in general, managers are appointed on their merits. There have been a few instances in which a manager has been the tool of a machine, notably Kansas City in the days of the Pendergast machine, but, generally speaking, managers carry on as could be expected of professional men seeking to improve their professional reputations. Kansas City, incidentally, has completely redeemed itself by making a record success with a first-rate manager from out of town.

There is an obvious advantage in having at the head of the city administration a man whose profession is city government. Even a moderate sized city in these days is a complex mechanism with many technical problems of which the average layman who may be elected mayor or councilman has no knowledge. A full-time manager, familiar with all these problems, can supply the skilled direction which is needed. All his self-interest is enlisted on the side of doing a good job which will advance him in his profession, normally by getting him a better job in some other city. This is in marked contrast to the politician's disposition to entrench himself politically in his home town.

One of the byproducts of the city manager plan of government has been the use of improved financial procedures. Most fundamental of these improvements is sound financial planning or budgeting. In all city manager cities a detailed estimate of receipts and expenditures for the conduct of the city during the ensuing year is prepared by the manager for the consideration of the council. As soon as adopted, an allotment plan is set up, apportioning the amount of each appropriation which may be spent in each monthly or quarterly period. To further secure the faithful carrying out of the budget as adopted by the council, city manager charters usually provide that no obligation to spend money can be incurred until the chief financial officer of the city has certified that there is an unencumbered balance in the appropriation applicable to that expenditure. In the opinion of most authorities on municipal finance, this officer should be appointed by the manager and should be the head of an integrated department of finance, including accounting, assessment of property for taxation, tax collection, and purchasing. Centralized purchasing has proved advantageous not only in avoiding waste, but as a means of administrative control over the numerous departments and agencies of large cities. Modern machine operated accounting, which permits the exact condition of every fund and appropriation to be available at all times, assessing on scientific principles, and effective tax collection machinery are found more frequently in connection with the city manager plan than any other form of local government. Altogether, improved financial practices, though they attract little popular attention, have had much to do with the success of the manager plan.

So far, only one city of over 500,000 population—Cleveland—has adopted the manager plan, and Cleveland has abandoned it. This

reticence on the part of the largest cities raises the question as to the adaptability of the manager plan to large city conditions. It is sometimes urged that a large city needs a political leader at the head of its government if public opinion is to be properly marshalled behind the activities of the city. There is certainly no other reason for rejecting the city manager plan as inapplicable to large cities. A centralized executive is even more necessary than in small cities and a professional administrator obviously could handle the details of the job as easily as an elected mayor. Probably the real reason for the absence of the great cities from the list of city manager plan cities is the strength in them of the political machines which almost uniformly have been hostile to the city manager movement.

No statistical demonstration of the superior results of city manager government is possible. Conditions vary so much from state to state and city to city that comparisons based on tax rates or government cost payments are almost always unreliable. Responsible students of municipal government never use them except as warning signals of possible extravagance. The best test of the city manager plan is to be found in its steadily increasing acceptance in smaller cities. The city manager plan, of course, is not an automatic guarantee of good government. It is, at most, merely a better mechanism for securing good government than the other current forms of city government in the United States. Like all other mechanisms its successful use depends on the wisdom and skill of those who operate it. It is the chief claim to credit of the city manager plan that it brings the two elements essential to successful administration in a democracy—popular representation and technical skill—into such a favorable relation as to produce a better average of results than any other system.

THOMAS HARRISON REED,
Municipal Consultant, Wethersfield, Conn.

CITY OF BROTHERLY LOVE (Gr. *φίλαδελφία, philadelphia, φίλος, philos, dear, and αδελφος, adelphos, brother*). William Penn gave the English rendering of the two words as the name, Philadelphia, to a city in Pennsylvania. The common rendering into English of the name of the city is City of Brotherly Love.

CITY OF DAVID, Bethlehem (modern Beit-Lahm, house of bread), supposed to be the birthplace of David, the place where his descendants had to go for the enrollment, when the census was taken by order of the Roman emperor. Jerusalem is sometimes called the City of David because he captured it from the Jebusites and made it the capital of his kingdom.

CITY OF DESTRUCTION, The. In Bunyan's *Pilgrim's Progress* Christian begins his journey at this city and journeys to the Celestial city. The place of beginning represents the world with its temptations, and the place of ending, Heaven with its joys.

CITY OF DREADFUL NIGHT, The. This well-known poem by James Thomson was first published in *The National Reformer* in 1874, under the initials B. V. for Bysshe Vanolis, Thomson's nom de plume. The work is the most

remarkable example in English literature of the unrestrained expression of intense and overpowering gloom. It has appropriately been called a "litany of pessimism." The author writes

"Because a cold rage seizes one at whiles
To show the bitter, old and wrinkled truth,
Stripped naked of all vesture that beguiles,
False dreams, false hopes, false masks and modes of youth."

His words are addressed not to the happy, not to "those pious spirits with a God above them," not to optimists who look for a heaven upon earth, but to desolate and fate-smitten sufferers like himself who see no ray of hope. The City is life—somber, desolate, a hell on earth. It is empty, save for wretches who move to and fro in the gloom like specters, speaking as with one voice the message of despondency and woe. In a succession of vague incidents, which give forward movement to the meditation, the poet encounters one after another of these shadowy figures. He hears a sort of atheistical sermon preached from the dark pulpit of a cathedral to a vast congregation of "spectral wanderers of unholy night," counseling despair and suicide. The poem closes with a memorable description of Dürer's *Melancholia*, whom Thomson makes the presiding goddess of his doleful city.

False as the note of unrelieved pessimism may sound to healthy ears, there is in Thomson's poem an unescapable appeal, due partly to the author's compelling power of imagination, partly to his mastery of the cadences of verse and partly to the very intensity of his mood. The atmosphere of gloomy mystery and the deep intonations of language in *The City* are said to owe something to the poetry of Poe; its melancholy is "compounded of many simples." Yet Thomson's poem remains not only highly original but unique. Thomson's poems were published in collected form by Reeves and Turner in 1880; for comment consult Walker, *The Literature of the Victorian Era*, and Stedman, *Victorian Poets*.
JAMES H. HANFORD.

CITY OF ELMS, New Haven, Conn., so called because of the numerous elm trees which shade its streets.

CITY OF GOD, *The*, a noted work by St. Augustine. This, the most important of all the saint's writings, was begun in 413, three years after the capture and pillage of Rome by the Visigoths under Alaric. The pagans had endeavored to show that this calamity was the natural consequence of the spread of the Christian religion, and the main purpose of Augustine is to refute them. The work was finished about 426 and comprised a total of 22 books.

CITY OF MAGNIFICENT DISTANCES, *The*, a name given to Washington, D.C. When the city was planned, the last of the 18th century, the long and broad streets, with here and there small parks, almost all of which were out long distances in broad fields, caused this name to be given to it in derision. Now its citizens are proud of the title.

CITY OF OAKS, a name given to Raleigh, N. C., from the size and beauty of some of the oak trees which adorn its streets.

CITY OF PALACES, a name applied to Calcutta, India, from the numerous palacelike edifices.

CITY OF THE PLAGUE, *The*, the name of a poem written by John Wilson (Christopher North), published in 1816. It is said to have been founded on the *Journal of the Plague in London*, by Defoe.

CITY OF THE PROPHET, Medina, Arabia, to which Mohammed fled from Mecca in 622.

CITY OF THE VIOLATED TREATY, Limerick, Ire., so named on account of the frequent infringements of the "Pacification of Limerick," concluded in 1691.

CITY OF THE VIOLET CROWN, Athens, Greece, the violet being the symbol of that city.

CITY PLANNING IN THE UNITED STATES. This article treats the history and the modern trends of city planning.

History.—City planning is probably as old as urban civilization itself. Once man began to build permanent settlements, problems arose which required thought for the future use of land and the establishment of safeguards for those uses. Common and unimpeded access to the water supply was in all likelihood the first and most imperative of these needs. The well was not the property of any one man, but of the community, and paths and roads leading to it likewise were common property. Certain plots of land became the property of individuals, whose rights to the land required description and definition. Reconciliation of the two uses, public and private, were the primitive bases of city planning. The physical fact and the legal status grew together.

The increasing complexity of permanent settlements makes it appear that certain decisions, that is, planning, must have been made in every city which ever has existed. The degree to which that planning was carried varied and no doubt depended largely on the degree of organization in the civilization which produced it. Certain very ancient cities show a very high order of planning, while others exhibit only rudimentary street patterns.

The accumulation of wealth in cities made defense against the attack of predatory bands another reason for planning; indeed the protection afforded by cities was one of the reasons for their growth. As nations increased in power and warfare became more purposeful and better organized, the importance of defensive planning increased. Most cities, besides being sources of loot, were also strategically located in respect to natural trade routes. They had grown naturally at such points, because trade was their primary function. Two types of cities, broadly speaking, therefore came into being. One was the hilltop city, the defensive power of which was concentrated in the compact citadel perched on a crag, the city itself being only partly protected. The other type was the city of the plain, usually surrounded by a wall. The planning was aimed, in the first instance, at permitting the citizens to get quickly into the citadel; in the second instance it was directed at getting the citizens to their fighting positions at the walls.

Thus accessibility of land for public functions and uses, the definition of land for private use, and the defense of both were the key problems from which city planning had its beginnings. By

the time when the great classical cities developed, another element of great importance had appeared—the element of civic pride. The rulers of the cities of antiquity wished to leave behind them monuments to their power and beneficence. Nor did large municipalities governed by aristocrats or oligarchs or democrats yield to cities controlled by kings or tyrants in their attention to building programs for utility or beauty. Great buildings and works of art arose, requiring splendid settings; plazas and forums for public meetings and the processions of armed might; temples, palaces, colonnades, and basilicas. City planning was architecture, and architecture was city planning. How closely these arts were related is clear in the remains of the Acropolis of Athens, in the ruins of Persepolis, in Rome, in the remnants of any ancient city in any part of the world.

The idea of the planned city was carried over Europe by the Roman legions, whose camps were constructed in quadrangles according to military directions which must have been very similar to those under which modern army camps are built: the cutting down of all trees and laying out of all structures in strict alignment, with wide roads for the massing of troops.

This Roman plan underlies many Continental and English cities, although in most cases the original regularity has been lost in the medieval confusion of narrow ways and densely crowded houses. The medieval pattern was quite different from the Roman because the method of warfare was different. The highly organized Roman legion disappeared after the fall of Rome, and centrally directed warfare on a large scale did not reappear until early Renaissance times. The cities of the Middle Ages were very small, very compact, hardly more than clusters of houses around the base of a fortress. Even the large cities, such as Paris and London, were limited in extent, and the land within the walls was utilized to the last square foot. Nevertheless the medieval city was also planned in its principal features. The principle of access for defense was still paramount, and the need for public approach to public spaces was not forgotten. The visual aspects of the cathedral or church were the main aesthetic considerations.

The transition to the Renaissance city, with its openness, its emphasis on the secular side of life, paralleled of course social, mercantile, and governmental changes. Riches increased, safety of person increased, while governments became stronger and more centralized. Perhaps most important of all, the new discoveries in mathematics, physics, and chemistry brought into use new methods of warfare, of which gunpowder and cannon were the new weapons of attack, the murderous product of a vast and far-reaching change in technology. The consequences for the city were the lowering of the walls, since the high masonry wall so effective against bows and arrows as well as the hand-to-hand attack were meaningless against the cannon and the gun. A new type of fortification was devised, and with it the new types of cities which would answer to the need for the mobilization of troops on a large scale: wide avenues, great plazas. Since again the rulers wished to commemorate themselves, civic buildings and palaces were designed to the scale of the great, wide avenues. Entirely new towns were built, completely planned, purposeful and self-contained, many of them beautiful in execution as well as conception. Some,

interestingly enough, were speculative ventures of princelings: homes and businesses in them were offered for sale in terms as glowingly deceptive as those of a modern subdivision.

The 17th and 18th centuries are the high-water mark of European city planning until the early 20th century, both in quality and in quantity. From it came the excellent early Spanish plans for Mexico City, Lima, Guatemala, Antigua, and a great many other cities of Latin America; and through other channels the fine plans of many northern colonial towns and of such occasional southern excellencies as Savannah, Augusta, and Williamsburg.

With the beginning of the 19th century the entire technological background of cities was changed by the Industrial Revolution. The pre-industrial cities were the product of civilizations which, while riches and well-being were not scorned, nevertheless attached many values to life other than material resources. The cities reflected this in a variety of ways; in the provision for the amenities of life, in a high regard for aesthetic values, in the relation of the urban complex to the rural scene. Much of this was unconscious; it was an accurate image of the spirit of the times. But the industrial city was no less an image. The growth of the use of money from a medium of exchange in the early days of the development of international trade to its complete domination of the mind and spirit of western man by the middle of the 19th century was paralleled by a degeneration of cities and by a deliberate spoliation of the urban idea, which was quite on a par with the spoliation of natural resources and with the degradation of the peasant and the craftsman into the slum dweller. Steam, smoke, and slums were the gift of the Industrial Revolution to the cities.

On the whole early American city planning had been excellent. The northern colonies followed the tradition of basing the economy of their towns on the use of land. The dwellings were collected around common lands, the farmlands were adjacent. Once the pioneering was done, there was no need for walls, and the towns grew spaciouly. When a community became too large for adequate intratransportation, new towns were founded. The southern tradition was slightly different, since it stemmed not from a democratic, puritan, agricultural background, but from aristocratic and liberal traditions to which was grafted slavery. The difference between Litchfield, Conn., and Williamsburg, Va., for instance, illustrates this. However, the influence of the southern tradition was limited, while the northern was spread throughout the Western Reserve and the territory adjacent to it.

A third influence became prominent after the city of Washington was designed by Major Pierre L'Enfant. This was the late Renaissance tradition, based on the effective placement of public buildings and on the connection of focal points by wide, radial avenues. Buffalo and Detroit show the traces of this influence.

When the United States really began to expand, and the westward march of industry began to follow the railroads through the wilderness, new cities were planned by the hundreds. They were laid out by surveyors and were deliberately planned for speculative expansion. The gridiron pattern of streets lent itself most easily for this purpose. In the first place, it is easy and quick to survey, since it is all straight lines and right

angles, and this matter of speed was of no small consequence. There were few surveyors and much work for them to do. Secondly, it provided the simplest method of lot description for sale and record. Thirdly, it provided an undifferentiated street system, an advantage because no one knew for what the land might be used—residence, business, or industry. For 50 years at least this surveyor's tradition was the dominant one in American city planning. Those were the years of expansion. Not only the numbers of cities increased, but also the older cities doubled and trebled in population from census to census. The swelling cities became choked with slums, built to house the immigrant workers, and some of these, notably in New York and in Chicago, became such breeding places of disease, crime, and human misery that efforts at reform were instigated. It was this revulsion against the slum that brought housing and the social aspects of urbanism into modern city planning.

A more direct influence for planning was the cumulative effect of rich and influential industrialists' visits to Europe and also of political bossism. The bosses had to have public works that they might have the proper source of illegitimate revenue. Many of our finest parks and public buildings are due to the most reprehensible characters. Like Julius Caesar, they sought to placate the public by gifts of parks and places of public amusement. The industrialists, returned from Haussmann's Paris, from Vienna, from Rome, felt the insufficiency of the gridiron and the cast-iron monument as an expression of a great and wealthy nation. In 1893 the White City in Chicago showed the people of the United States what could be done. The "City Beautiful" movement got under way. This movement lasted well into the early years of the 20th century. Its emphasis was on the outward aspect of cities, the civic centers, boulevards, plazas, the grouping of important structures, and the placement of monuments. Its inspiration varied from the "grand plan" of the French influence to the cottage village of the English. It completely ignored the economic aspect of planning and was unaware that there were social implications. Nevertheless it aroused the interest of great numbers of people and so prepared the way for the more serious planning which was to come.

During the 1890's abroad were important developments which eventually exerted powerful influences on American theory and practice. Camillo Sitte published his book, *The Art of Building Cities*, and Sir Ebenezer Howard published *To-morrow, a Peaceful Path to Real Reform* (later retitled *Garden Cities of To-morrow*). Sitte's book was effective only indirectly in this country. It was translated from Italian into French and was current in England, but not until 1945 was it translated into English and circulated in the United States. It was through European and English practice that his theories were spread. Howard was successful not only as a theorist, but two "garden cities," Letchworth and Welwyn, were built along the lines suggested by his book. Both works, in varying degrees, emphasize that city planning is planning for living and that social and economic considerations are of paramount importance. On the well-being of the citizen and his family everything else rests; his well-being depends on his ability to earn his livelihood and to rear his family in decent and healthful surroundings: this is Howard's theme.

Sitte develops the organization of the medieval city as a social-physical organism; its aesthetic unity is derived directly from the life of the people.

The first decade of the 20th century saw the beginning of modern city planning. As Professor Frederick J. Adams has pointed out, 1909 is a key year. It was in that year that the first British Housing and Town Planning Act was passed; it was in that year that the Chicago Commercial Club published the great Burnham Plan; and it was in that year that the first National Conference on City Planning was held in Washington, D.C., at which the participants laid strong emphasis on the need for economic studies in city planning and on the importance of comprehensive and coordinated treatment of city problems.

By 1916 the overcrowding of land in downtown New York City reached such serious proportions that the first zoning law regulating height and coverage of buildings and use of land was passed. The straw that broke the real estate interests' back was the Equitable Building, the size and bulk of which was an obvious threat to all buildings in lower Manhattan and to the physical use of the streets and to the transportation system. It was characteristic that all efforts to regulate use of land and to establish effective controls had failed until commercial interests were jeopardized; nevertheless the validity of zoning as a comprehensive method of control was established. It was the first step toward giving cities adequate planning powers.

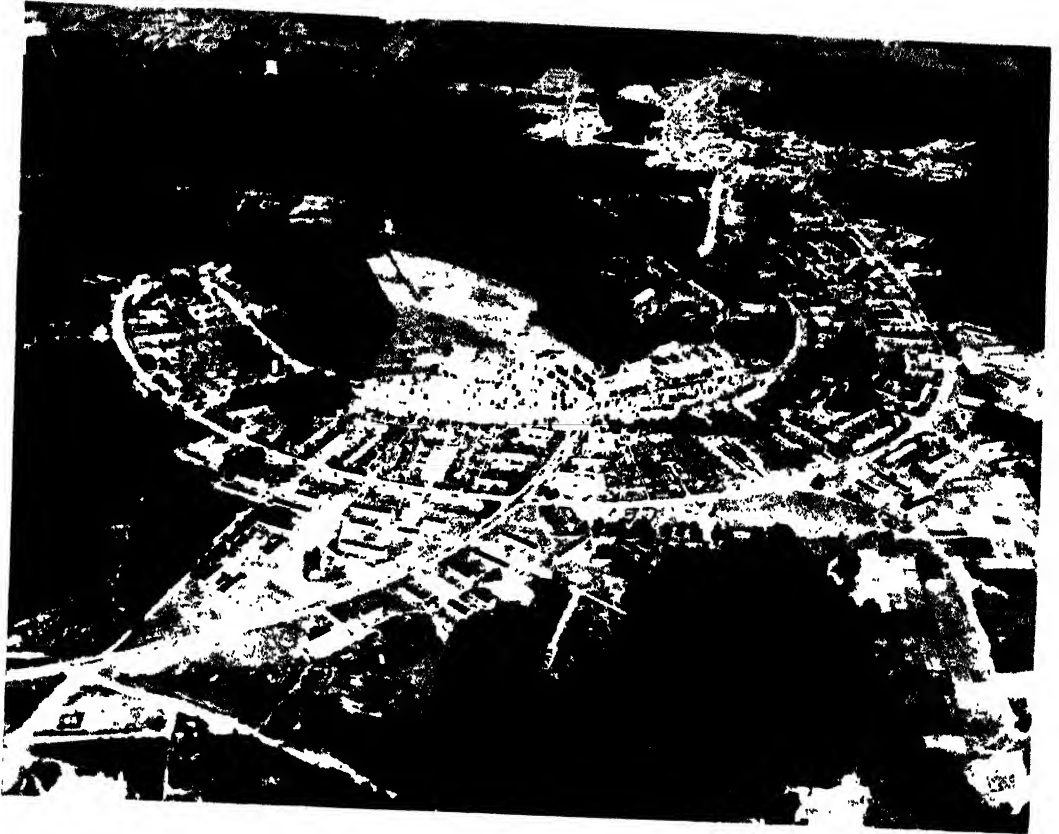
World War I saw the application of English ideas to war-industry towns under the leadership of such architect-planners as Electus D. Litchfield, Frederick L. Ackerman, Clarence S. Stein, Henry Wright, and others. This work paved the way for Radburn, N. J., the first community planned in full recognition of the fact that the motorcar was here to stay. Thus within a score of years city planning took major and maturing strides in both its branches: the control of land uses in existing cities and the designing of entirely new communities.

Current Planning.—City planning in the mid-20th century is not concerned merely with the physical aspects. Important as these are, they are regarded as the purposeful end of a complex of many factors. Put in another way, the three-dimensional physical city is conceived as a means for accomplishing social ends rather than as an end in itself. As a practical matter, the economic status of a city must be included in the planning, since the social structure rests upon the economic base. A bankrupt-city can do little to help itself; a new town, without economic support, is doomed to failure.

The planning process for existing cities differs widely from the planning of new towns. Existing cities must be dealt with by amelioration. The emphasis is on trying to get each successive change in the city structure to be a part of a long-range plan for the general betterment of the community as a whole. The existing conditions of the city are analyzed and listed as a sort of civic inventory, and there is developed a program which, it is hoped, may in due time come to be realized, at least in part. In planning new towns the planner is reasonably free to use the newest ideas and techniques consonant with the sponsor's program.

The problems in existing cities, while varying widely in detail, are generally categorically simi-

CITY PLANNING



An aerial view of Greenbelt, Maryland.

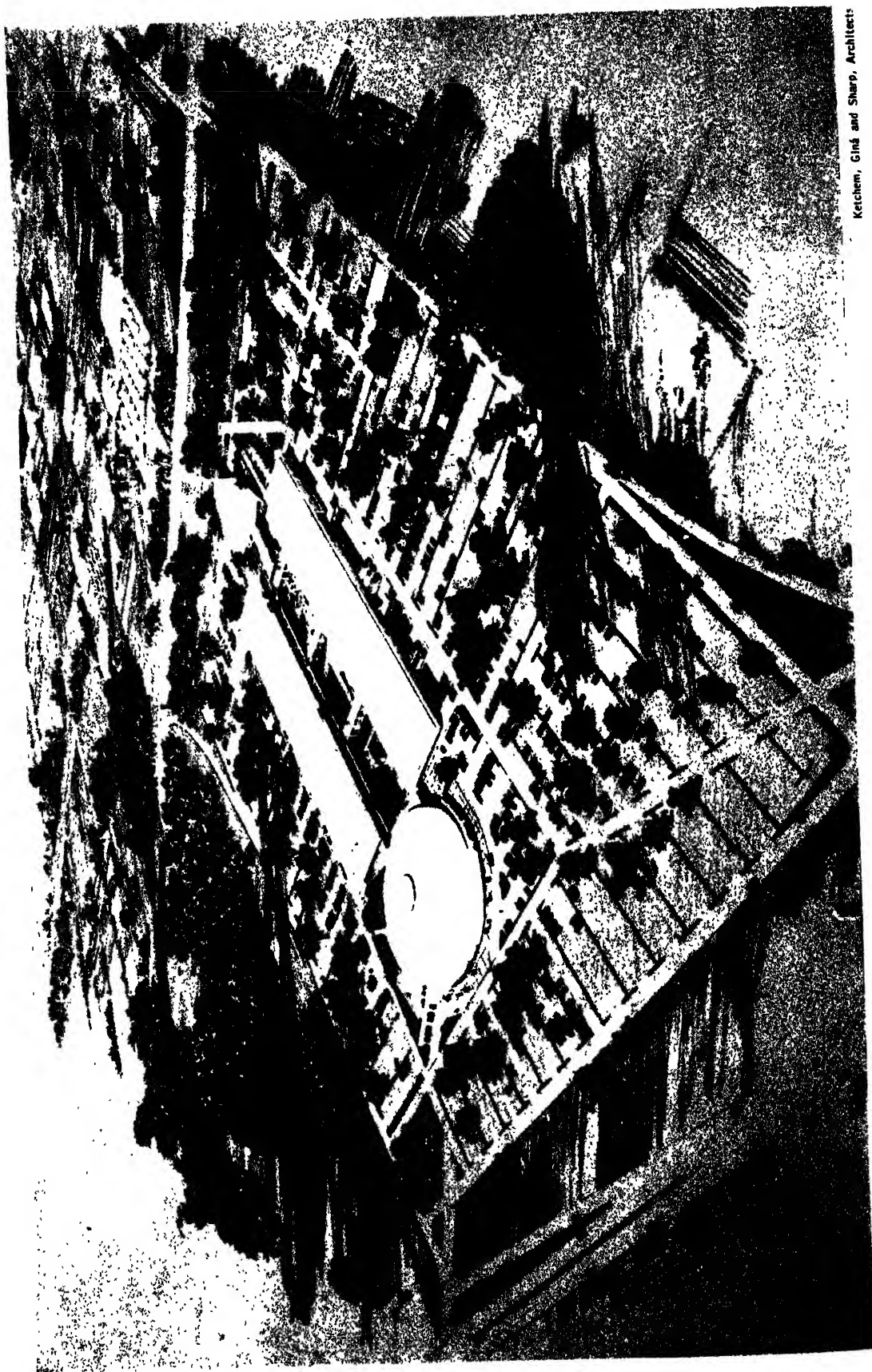
Photograph by Fairchild Aerial Surveys, Inc.



An "urban sprawl," Youngstown, Ohio.

Photograph by Fairchild Aerial Surveys, Inc.

CITY PLANNING



Ketchum, Gish and Sharp, Architects

Perspective of a regional shopping center. Middlesex Center, Framingham, Massachusetts.

lar. Congested streets, slums and blight, deteriorating business areas, worn-out public utilities, a strong tendency toward decentralization, and virtual bankruptcy are the major classifications. These ills have resulted from a variety of interrelated causes, most of them stemming from the technological changes which have occurred since the cities were laid out. Chief among these changes or, more properly, inventions are the internal combustion engine and electronics. The probabilities are that the technological changes inherent in atomic fission will prove no less a cause for obsolescence. The automobile has been a principal factor in freeing people from the congestion of the city. The movie, the radio, and television, added to the telephone, have released people from the necessity of being in a city for instruction and amusement or to maintain social and business contacts. Perhaps equally important is the higher standard of living, which has brought to many the realization that their children can have a better physical environment and a better education than the congested city provides. In the big city political corruption and educational stultification must be endured. The suburbs, smaller and with more human scale, offer greater opportunity for the individual to participate in local politics and in school control.

Congestion of traffic and overcrowding of land, that is, excessive population density, are both cause and effect. There is virtually no technical limit to the possible overcrowding of land. When, with a given sheet-pattern of limited capacity, the congestion becomes economically intolerable, a trend toward decentralization starts and the congested area begins to deteriorate. Frantic efforts then are made to solve the traffic problem. These efforts are, in general, hopeless, because the traffic problem is not a traffic problem at all, but a density, or population, problem. Any real solution is out of the question, because of the huge investment in real estate and in buildings, because of the consequent high land values, and because the tax base of the city is dependent on maintaining these values, no matter how fictitious. Redistribution of population and industry would seem to point to a solution, and this is also in line with the historical trend of technological changes.

The problem of the city planner is to deal with these matters as best he can.

Within our democratic framework the planner has various methods of approach and various tools which have been created by legal decisions over a considerable period of time.

The earliest effective tool, as previously mentioned, was zoning. This power rests on the concept of the police power of the state and depends entirely on the attitude of the courts toward the interpretation of "health and welfare." Zoning is now well established, although the extent of its power varies greatly from jurisdiction to jurisdiction. Widely regarded as a device for maintaining the status quo in land values and land uses, recent attempts by planners to give it a more dynamic use seem to be gaining ground in many communities.

Somewhat akin to zoning is subdivision control, which is a device for controlling the layout of undivided land. The alignment of streets, the provision of utilities (such as water, sanitary sewers, and storm drainage), the size of lots, provision for parking, and similar matters are controlled by the requirement that each subdivi-

sion must have the approval of the planning board before the plan can be filed for record.

Both zoning and subdivision control come under the jurisdiction of the planning board. Zoning variations, however, are usually handled by a board of appeals, or adjustment, whose powers are confined to "variation" or "adjustment" within the framework of the zoning law. Actual changes in the law are, of course, a matter of local legislative action, usually upon the recommendation of the planning board.

Both zoning and subdivision control suffer from the ignorance of the generality of officials appointed to administer them. Boards of zoning appeal are prone to yield to local pressures and often exceed their statutory powers in granting "variations," which in actuality are not variations at all, but changes in the law, which should be granted only by the local legislative body. While theoretically there is recourse to the courts for such illegal action, in practice the cost of court proceedings is prohibitive except in the most flagrant cases of abuse of power.

The weakness of subdivision control is that it controls neither the amount nor the location of subdividing. The abuse of this privilege by irresponsible speculators has resulted in literally hundreds of thousands of lots being thrown on the market, remaining unsold, and eventually becoming tax delinquent.

Planning boards, in general, derive their authority from the local legislative body within the framework of a state enabling act authorizing municipalities, and sometimes counties, to create such boards. They are appointive; the members are unpaid, except in New York City. To be at all effective, there must be a paid staff of men trained in the field of professional planning. If the board becomes politically objectionable, funds are withheld and the board becomes inoperative. The board's function is largely advisory, except in those places where they have very considerable power through the control of subdivision. Their principal activity is the preparation of a master plan, or comprehensive plan, which is intended to serve as a guide toward the development of a community. In a few states this plan can be adopted by the board after public hearings and, when so adopted, it becomes mandatory upon the local legislative body and the municipal departments to refer all public improvements to the board for approval. If the board disapproves, it requires more than a majority vote (usually three quarters) of the legislative body to override the board.

The master plan at one time was considered the main objective of city planning. It is now not so regarded. Many cities in the past acquired a plan, and there the planning ended. Present practice tends to view the master plan as only a preliminary step toward planning. It is a highly necessary step, because it gives the present picture and the objectives to be attained as of the present. Planning, however, is a dynamic process; the city grows and changes, and every municipal action has far-reaching consequences. The real task of the planning board therefore should be—and is, in those communities where planning is taken seriously—to serve as a research arm to the executive. "Pure" planning, planning according to theory, is a practical impossibility, for every executive decision is weighted by many factors of politics, expediency, finance, and local pressure. A conscientious executive and legislative body,

nevertheless, can be assisted greatly in making decisions, if presented with the full implications, city-wide, of the alternatives.

Because of limited powers planning boards must work closely with city departments and seek to have them forward overall planning objectives as part of their own departmental plans. The traffic problem involves, for example, a department of highways, the police department, and very often county, state, and federal departments or bureaus. These bodies may, and often do, have conflicting ideas, and the overall data of the planner may have significant effect on their determinations. Each of them is likely to approach a specific problem with professional bias to the exclusion of any collateral effects on the economic or the social structure of the city. Highway engineers, for instance, have little knowledge of and no regard for the economic or the social effects of their proposed alignments. It is the business of the city planner to take into consideration, insofar as possible, all relevant data and to present these impartially.

In matters affecting housing and clearance of slums the health department and the housing authority, if there is one, become involved. The selection of areas for clearance and the statistical incidence of disease, of crime, and of delinquency are all matters of importance to both bodies. The proposed density of new housing projects, their relation to traffic arteries and transportation, the provision of commercial facilities, and the existence or nonexistence of schools and of recreational areas are of prime importance in the general pattern of the city as envisaged in the master plan. It is for this reason, and because housing is the most potent factor in the realization of a "plan," that housing enabling acts almost invariably require a close connection between the housing authority and the planning officials.

School boards are usually autonomous bodies and accordingly jealous of their status. Cooperation between the school board and the planning board is therefore highly desirable; the guidance of the master plan data relative to population growth, the location of new highways, and other transportation changes are distinctly relevant to the building program of the school board.

With the growth of large-scale housing by institutions, such as insurance companies, an increasing number of states have laws extending the power of eminent domain for the benefit of such companies. In the majority of such laws the planning board is empowered to review site location, density, and other elements of the proposed project. Here again the objective is to safeguard the development of the city along the lines of the master plan.

In a few cities, notably New York City, the planning board reviews the budget of capital expenditures. In New York City the planning commission (the title in that city) actually prepares a five-year capital budget and sends the current year's budget to the board of estimate, which can delete but not add. Such procedure is rare; in general planning boards are limited to review and to making their recommendation or to silence.

The effectiveness of planning boards has grown since 1940 both in influence with politicians, who are responsible for the management of cities, and in legal fact. Court decisions in favor of zoning, of housing, and of parking authorities, and recently of redevelopment acts (to be discussed

later) have given them increasing power over a widening sphere.

On the social side the so-called neighborhood concept has been one of the chief developments. This idea was first clearly formulated by Clarence Perry and is based on planning neighborhoods within existing communities, each neighborhood to be centered around the school and to consist of a population large enough to support it. Each neighborhood would have its own shopping center and recreational facilities and preferably would also be a geographical entity separated from other neighborhoods by streams, main highways, parkways, or other barriers. It is part of the concept that such neighborhoods would help to resolve the overpowering largeness of the city, thus restoring, in some measure, individual initiative in local affairs, and recapturing for the individual the feeling of "belonging" which accompanies participation. The objections to the concept, when taken too literally, are that the population required to support a school is far too large for neighborliness in the true sense, that the area of such a district is too small for satisfactory planning, that most school districts are not related to geographic entities, and, more important, that there is no evidence that such planning would achieve the social objectives expected of it.

In fact it may be said that the social sciences so far have contributed little to the city planner. There have been studies of certain limited aspects, on a minor scale, by the late Professor Edward Lee Thorndike, Professor Stuart Chapin, Professor Svend Riemer, and a few others, but even these have been directed more toward housing than toward city planning. Sociologists should develop new techniques for the study of the social effects of such factors as physical patterns of communities upon social attitudes, relation of work to residence, lack of trees and of green areas, and general detachment from the sense of natural cycles, whether neighborhood community facilities do or do not alter the social pattern.

Study is also needed concerning the causes of growth of cities and of urban areas. There are studies of population growth by Professor John Q. Stewart of Princeton and the late Professor George K. Zipf of Harvard, which attempt to analyze demographic factors on a mass-statistical basis. These studies are promising, but wider research and much more interpretation are necessary before they will be of value to the city planner concerned with specific problems, since, as with all mass data, their value becomes less and less the more particular is the application.

Studies in the social and demographic field undoubtedly will be forthcoming, for the growth of what Dr. Don Bogue has termed the metropolitan community is of ever-increasing importance. The influence of the central city over the surrounding region is ever more powerful despite the fact that in many ways the central city is disintegrating. The resulting conflict in planning objectives cannot be rationally resolved until the forces at work have been subjected to much closer analysis and their effective implications have been brought at least into the form of a working hypothesis. Until such hypotheses have been formulated and tested, there is no basis upon which the planner can decide whether the process of decentralization should be accepted as inevitable or whether redevelopment, as the term is currently used, does or does not make sense. It

is probable that this absence of social data, as related to physical planning, is the reason for the lack of a sound philosophical approach to city planning as a whole and accounts for the failure of planning, at this time, to be much more than a series of expedients.

Traffic and Transportation.—This is the foremost problem of every city. Efforts to deal with it consist of street widenings, separation of through traffic and trucks from local traffic by designating certain routes, prohibition or limitation of parking. Recent more drastic measures have been to build through highways in such a fashion as to avoid intersections; for the municipality to acquire and to operate parking lots; and to require, by zoning, provision for off-street loading and parking for new traffic generators. The upcurve of automobile production and of owners' trip per capita, the increase in population, and the failure to recognize the relation between traffic and land use make most of these efforts abortive. In very large cities the lack of any correlation between places of work and places of residence is an added factor to transportation difficulties, and the increase in commuting is rapidly creating virtually insoluble problems of terminal trackage for the commuter railroads.

Slum Clearance and Housing.—Slums are more recognized as both a social evil and an economic menace. The areas of slum and blight in the majority of cities has reached proportions far beyond that with which the city is able to deal; hence the acceptance of public housing as a step toward civic improvement. However, neither public housing alone can begin to utilize all the areas needing clearance nor can the cities afford to purchase and to clear these. It is doubtful if intensive economic use ever can be made of all the land needing redevelopment. New concepts of density, taxation, and city patterns must come into being before the answers to this problem can be found.

Taxation and Budget.—The cities are finding it more and more difficult to raise sufficient funds for municipal services. The demand for social services of various kinds continues to increase also, largely due to the rising standard of living and to the fact that, as our civilization becomes more and more highly technical and specialized, more and more things formerly furnished by individuals or families for themselves cannot be so supplied and become the concern of government. Coupled with this is a declining tax base due to the flight of people, business, and industry from the central city. It is quite evident that the conventional methods of real estate taxation cannot meet this problem.

Public Utilities.—By this is meant the basic city services of sewers, storm drainage, water, streets, garbage collection, and, in some cities, gas and electricity. The cost of expanding these services is an important capital item related to the uncontrolled expansion of cities. In many cities maintenance is also a serious item because of wear and tear and obsolescence. In general, however, water services usually pay a profit, as do sometimes the gas and electric services. The planner therefore is concerned principally with control of expansion and with the purpose of securing an even growth of sewers and streets

without having to cross wide areas without population.

Industrial Development.—The proper provision of suitable areas for industrial expansion is an important part of city planning. In the past, industry first pre-empted water-front property

usually was relegated to any land not considered good for anything else. As a consequence of the use of motor trucks, of electric power, and of the assembly-line technique, industry is no longer tied to the railroad; it is not a dirt and smoke generator; and it requires more horizontal space. The reorganization of industrial areas in relation to places of residence, to arterial highways, and to allowance for plant expansion and for parking is now recognized.

Schools and Recreation.—The character of schools is changing rapidly. The one-story school properly oriented for sun, related to the scale of the child, and with large outdoor play areas is supplanting the three-story "monument" with an asphalt yard. There is a growing use of the school for adult education and for community use. Planners and educators are realizing the importance of acquiring large sites well in advance of population growth, and in this the planner can advise the school board of trends and of plans for such population generators as new highways or industrial locations. Parks and playgrounds, usually in charge of a separate city department, are in somewhat the same category and often are operated in cooperation with school facilities.

Airports.—The location of airports requires much study. They require large areas of land; the clearance for take-offs and landings create problems of zoning. Quick transportation to the center of the city must be provided, often by new highways. The effect of the noise from the planes upon property values, or of the hazards of crashing, have not as yet been determined to any considerable degree. It seems probable because of the certainty of great technical improvements in airplanes that whatever is planned now will be obsolete in the near future. Indeed, most of our airports already are at least obsolescent.

Zoning and Subdivision Control.—These are tools which the planner must keep sharpening and which various pressure groups keep trying to blunt. His problem is to convince the public and the city council that they are not instruments of repression, but are for the guidance of population growth and for the distribution of the various principal uses of land and consequently help the economic functioning of the city as a whole.

Public Relations.—Planning, to be effective, not only must be accepted, but also understood and supported by the influential people of the city. Ideally, the members of the planning board itself, or at least the chairman, should be the ones who establish relations with the public through the press and through civic organizations. Too often they tend to allow this important task to be relegated to the director of the technical staff, whose business should be planning, not speechmaking.

Redevelopment.—This will be discussed later in this article.

New Towns.—No less important for the future is the growing interest in what the English call the "New Towns" movement. Here, too, there is historic background. As previously observed, the expansion of trade and international war in the mid-17th century saw the founding of a very great number of new communities and the

remodeling of many others for defense against the new weapons of the period. Some of the towns were exceedingly beautiful. There were books on the theory and practice of town planning, based on a variety of concepts, both aesthetic and military, usually derived from some geometrical or mathematical formula. Because of technological limitations, largely in the fields of transportation, logistics, and other military considerations, these towns were limited in size. Many of these towns still exist, but in most cases they have disappeared in a morass of industrial slums, have overflowed their boundaries, and have lost their original character.

The modern New Towns movement may fairly be said to have commenced with the publication of Sir Ebenezer Howard's *To-morrow*. There were, of course, forerunners, at least in the general social theory. Robert Owen in the early 19th century was one of these forerunners, as were the founders of various utopias, such as the Fourierist colonies, the Oneida colony, and others. It was Howard, however, who first expounded the full theory of the satellite city, planned for living and working, limited in size by an inviolable agricultural greenbelt, properly related by transportation systems to other cities of its class, all of them related to the central city. The time was ripe for such an effort, there was current revulsion against the horrors of the slums of industrial England and against the filth and the grime which pervaded all except the wealthiest sections. Two towns, Letchworth and Welwyn, were built during the enthusiasm for Howard's ideas, under the technical guidance of Louis de Soissons and Sir Raymond Unwin.

The movement was brought to the United States by a group of men under the leadership of Alexander M. Bing, a New York real estate investor. The eventual result was Radburn, N. J., for which the site planner and architects were Henry Wright and Clarence S. Stein, together with Frederick L. Ackerman. Radburn, designed as a self-contained satellite to New York, marked the beginning of public realization of how a town could be designed for modern methods of transportation and living.

There had been many self-contained residential communities, mostly built for or around a particular industry, but they failed to consider the automobile as the primary factor to be dealt with. Yorkship Village, near Camden, N. J., built for shipworkers during World War I and designed by Electus D. Litchfield, was one of the best. Others were Longview, Wash.; Alcoa, Tenn.; Kingsport, Tenn.; Kohler, Wisc.; Mariemont, Ohio; and other, smaller, strictly "company towns."

Radburn, like its English prototype, failed to realize its sponsors' hopes of becoming a completely self-sustained community. Since industry was slow in coming, it turned into a dormitory town. Its essential planning characteristics, however, proved their worth, notably the superblock, the cul-de-sac and narrow "loop" lane for residential traffic, and the provision of community amenities and "built-in" safety for children.

Other contemporary developments were taking place in Germany under the leadership of Ernst May in Frankfurt, in Holland under J. J. P. Oud, Arie Keppler, and others. Le Corbusier (real name Charles Jeanneret) was beginning in France to elaborate his theories of La Ville Radieuse, the city of far-spaced skyscrapers, a highly mech-

anistic concept which was to have great influence on the thinking of the younger generation of American architects and planners.

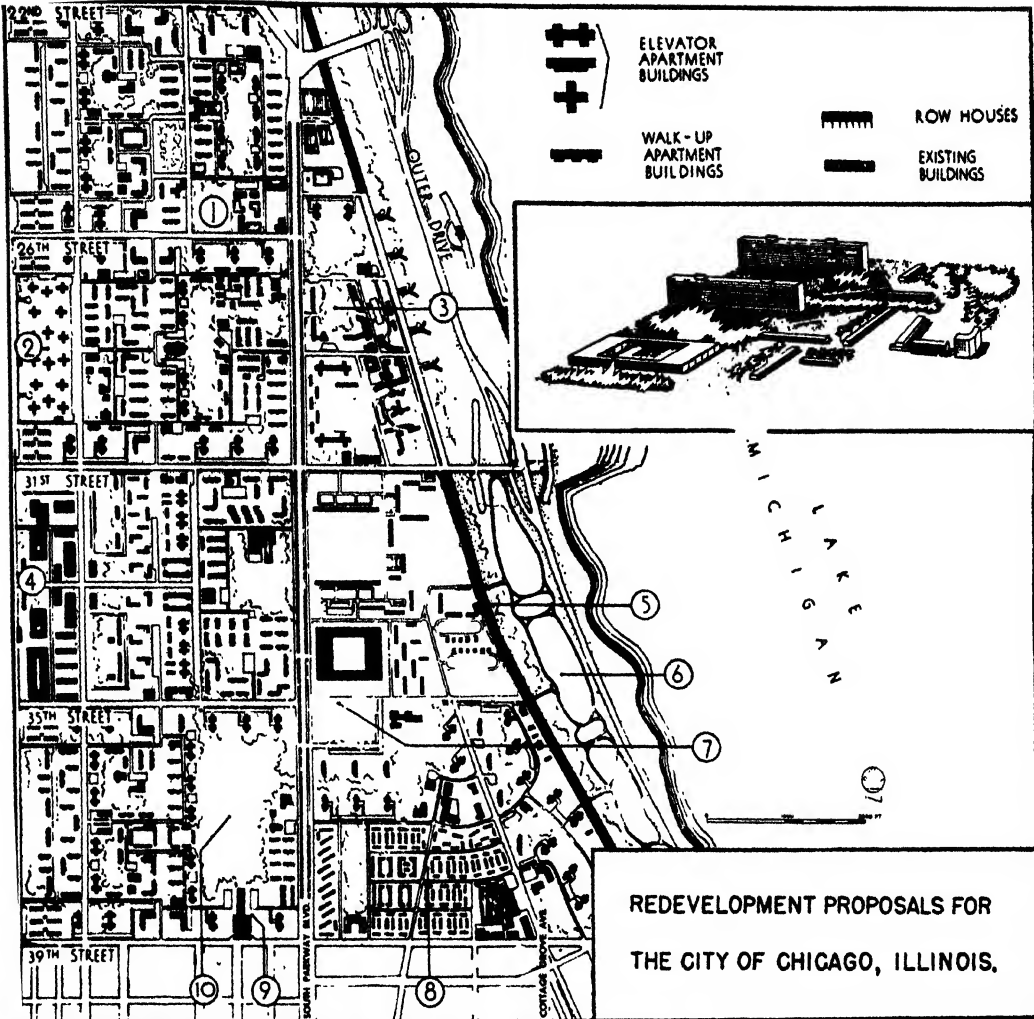
The financial depression of the early 1930's brought great strides. The emphasis on large-scale public housing introduced the notion of "the planned community" not only to the public but also, equally important, to the architects. It demonstrated vividly what was wrong with our cities as living spaces, and proved that there was the possibility of other and better ways of organizing them. The demonstration was carried into the New Towns field through the construction of the three greenbelt towns of Greenbelt, Md., Greenhills, Ohio, and Greendale, Wisc. They were planned and built by the Suburban Resettlement Administration as part of the pump-priming program of the New Deal. These three communities carried the Howard idea farther than it had been possible to do at Radburn and technically continued and further developed the "Radburn idea."

World War II advanced the techniques of new town planning through the many defense projects and towns, most of them temporary in nature, throughout the nation. Even though temporary in type of construction, town planning principles necessary to good circulation, safety, social amenities, and even aesthetic satisfaction were employed. Much was learned from them.

The issue in the mid-20th century is a conflict between the need for modernizing our existing cities and the need for controlling the unorganized sprawl which is the result both of the push from the city and of the great growth of the metropolitan areas by migrants from the country. While the ideal solution probably would be a series of self-contained, related, and well-organized satellite cities or "New Towns," this seems hardly probable of attainment. Other types of organization have been advocated, but, as long as there is cheap land to be exploited, any concerted effort to organize and to control development most likely will prove to be in vain. This is not to belittle the importance of the problem; urban sprawl very well may prove, in the future, to have been our worst crime in the wasting of natural urban-regional resources.

Redevelopment.—While we are permitting our suburban areas to become tomorrow's slums, we are struggling to find some method of doing over the slums and the blight left to us by our predecessors. The central portions of most cities began to deteriorate even before the advent of the automobile, as electric mass-transportation opened adjacent areas. The automobile accelerated the process and, as time passed and as the number of cars increased, the problems of traffic congestion and of parking brought more blight. Enterprising merchants realized that the outlying shopping center, built for cars as Radburn was built for cars, could prove profitable. The astonishing success of such centers, large and small, began to have its effect on downtown business. Industry, hemmed into undesirable sections of the city, unable to expand, its flow of materials hindered by traffic, also realized that outlying areas were more satisfactory places in which to locate. The effects of these various movements were interacting and cumulative. The cities were left with developed but obsolete areas, into which no one would invest money because no single enterprise could reverse the trend. Not only were the land valuations very high—para-

CITY PLANNING



Courtesy Michael Reese Hospital Planning Staff and PACE Associates, Architects

These proposals were being partially implemented in 1951. Locations are identified as follows: (1) Mercy Hospital; (2) Chicago Housing Authority project; (3) Michael Reese Hospital; (4) Illinois Institute of Technology; (5) Chicago Memorial Hospital; (6) Burnham Park; (7) Community shopping center; (8) Ida B. Wells homes; (9) Wendell Phillips High School; (10) Proposed playfield.

From Zellier-Merian, courtesy New York Public Library

An old plan of Charleville, on the Meuse River, France: a city of palaces, churches, and convents.

CITY PLANNING



Radburn, New Jersey: plan of the northwest and southwest residential districts. The essence of the "Radburn Idea" lay (1) in the use of large park areas in the centers of the "superblocks," which were designed to replace the traditional narrow, rectangular block; (2) in the differentiation of roads for specific purposes: through roads to other sections, collector roads around the superblocks, and service lanes for access to the buildings themselves; (3) in a separation of automobile roads from pedestrian walks, including the use of overpasses and underpasses; and (4) in the orientation of utility rooms, such as kitchens, toward the roads, while living and sleeping rooms faced the gardens and parks.

doxically often the most badly decayed areas were valued the highest—but also the multiplicity of small holdings made the acquisition of large plottage a virtual impossibility.

It was obvious that certain incentives would have to be elaborated to attract investment capital. The large insurance companies, desirous of investing large sums with a minimum of risk, were the first to evolve a tentative method of action. The success of New York's limited-dividend housing program pointed the way. The first redevelopment company laws were enacted to permit large limited-dividend projects to be erected with the equity money of insurance companies. They provided also for the exercise of eminent domain, for tax exemption of the improvement, for arrangements with the city for the closing of streets. In return, rents were limited.

Redevelopment laws soon were enacted in other states, broader in scope than the New York prototype. Finally, after two years of debate Congress passed the Housing Act of 1949. Title I of this act deals with the redevelopment on a national scale. Funds are provided from which loans and grants can be made to cities for acquiring land, demolishing the old structures, re-planning and selling or leasing for the planned purpose. The land may be sold for its "use value," and two thirds of any loss is paid by the government, the remaining one third being borne by the city. The stated purpose is for clearance and redevelopment of slums and blighted areas, but there is provision for loans, but not grants, for the planned development of open land. The object of this was twofold: mainly to provide funds for building the necessary and required rehousing of dispossessed families, and partly to be an opening wedge for the possible creation of new towns. The act requires: (1) either state-enabling powers for the creation of locally controlled redevelopment agencies or assumption of the burden by local legislative bodies, (2) conformance to an officially approved comprehensive plan for the future development of the city, (3) responsibility of private enterprise for carrying through the redevelopment. The federal powers are vested in a special division of the Housing and Home Finance Agency. The intent of the act is that all initiation and execution shall be at the local level.

The opportunities opened by this legislation are enormous. It remains to be seen how much will be done, and how well. There are certain obvious difficulties, the chief ones being whether the incentive to private enterprise will prove sufficient, whether the real estate market can absorb the new offerings at economic levels, whether the municipalities can meet even the one third of the write-off. These, of course, are economic questions; for the city planner the difficulty will be whether he will replan along the lines which the automotive and electronic age demand for decent living and working or whether he will be forced into a repetition of projects of high density, which will be obsolete before the work is started, by the dictates of an outworn system of speculative real estate practice and an ancient tax structure.

The ultimate success or failure of redevelopment will be a test of the modern techniques of city planning. In Philadelphia there appears to be a strong and persuasive current toward accomplishment. Over a period of years the various municipal departments and the public generally

have been convinced of the need for action. Citizen groups in various blighted areas have been encouraged to take part in determining the future of their surroundings. Intensive and valuable studies of social and business conditions have been made. In Chicago other methods appear to be having success. In that city the Michael Reese Hospital, once favorably located in the South Side, found itself isolated in a vast area of slum and blight. Instead of moving, it sought to be of greater service by trying to rehabilitate the environment. It organized a planning staff for this purpose, using its own expansion program as a starting point. Together with the expansion program of the Illinois Institute of Technology, the New York Life Insurance Company, and the Chicago Housing Authority, a large and comprehensive scheme for the rebuilding of a great segment of the South Side has begun.

San Francisco, Los Angeles, Detroit, Indianapolis, Providence, and many smaller cities have active redevelopment planning. New York City alone among the major cities has done little except to effect routine zoning changes. However, a comprehensive study, which is intended to lead to rezoning, was almost completed in 1950, and an era of greater official activity appeared there. New York City's problems are, of course, the most complex of any city's; on the other hand its planning commission has greater powers than those of other cities, and, if political difficulties, public inertia, and opposition of powerful interests can be overcome, great things may be expected from the rebuilding which occurs continuously in the metropolis.

Professional Progress.—These years of growth of city planning have seen the rise of a new profession, that of city planning. The early modern planners were recruited generally from the professions of architecture, landscape architecture, or civil engineering. The increasing complexities of the work have proved the need of special training. Knowledge is needed from many disciplines: architecture, engineering, economics, sociology, law, public administration, and public relations. The planner is not, and can not, be competent in all these; it is necessary, however, that he have knowledge of their general content, of their specific application to city planning, and of their relation to one another in civic matters. There are now courses leading to degrees in city planning in many of the principal universities. They are usually postgraduate; the recent trend is to accept a graduate degree in any of the related disciplines instead of requiring, as formerly, that the student hold a degree in architecture or in engineering.

Organizations concerned with city planning also have multiplied. The American Institute of Planners is the leading professional organization and publishes an excellent journal. Administrators and practitioners are together represented by the American Society of Planning Officials, an influential organization which renders informational and research services; there are many local or regional technical organizations. In addition there are local organizations of interested citizen groups in almost every large city. These perform public-relations services, act as sounding boards and pressure groups, and often initiate studies of specific problems. The growing interest in regional planning for metropolitan areas is evidenced by the increasing number of official or semiofficial bodies organized to deal with these intercom-

munity problems. The oldest and best known is the Regional Plan Association of New York, a private organization which was responsible for the first really comprehensive plan of New York City and its environs and which continues to develop cooperation among the various communities in the metropolitan region.

Summary.—City planning today, then, is not like the city planning of the past. It is concerned with broad objectives in many fields, not just with the physical aspects. Indeed the pendulum may have swung too far, for the present-day complete neglect of the aesthetic side of city planning may prove harmful in the future. Civic pride is an important factor in the psychology of any community, and civic pride is evidenced in the three-dimensional quality of the physical city. It is in this field that the architect must resume what, to specialized planners today, seems to be a disproportionate degree of control of the planning process, particularly at the point of actual execution. For the most part, however, planning is a work of coordination and guidance rather than of execution and administration. In our democratic society this often leaves the planner frustrated, because there is no direct way of attaining major objectives in the way in which Baron Haussmann attained them in Paris, or Pope Sixtus V and Mussolini attained them in Rome. Progress is made slowly. Momentum has gained, nevertheless, and the Housing Act of 1949 points the way to further action. It will be still increased as the plight of the cities increases and as need for redevelopment becomes imperative. Objectives will have to be clarified, and this is one of the major tasks of the new profession. Public and political acceptance of controls needs to be encouraged. New legal devices and economic reorganizations must take place. The results should be both cities rebuilt to new patterns and new towns in place of suburban sprawl. The basic financing should be the least of the difficulties, for we rebuild the United States continuously. It is a matter, primarily, of planning for the common good instead of allowing haphazard growth for the temporary benefit of a few. Such action must come from the people; it cannot be imposed from above. City planning today is, therefore, an integral part of the democratic process.

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HENRY S. CHURCHILL.
Architect, City Planner.

CIUDAD BOLIVAR, syōō-thāth' vō-lē'vār, city, Venezuela, capital of Bolívar state, on the Orinoco, 240 miles from its mouth. It is an important river port. It has a hot, tropical climate. It is the focal point of the Orinoco River trade. The exports are hides, balata gum, tonka, beans, medicinal plants, chicle, indigo, woods, gold, and diamonds. The industries are saw-milling, rice milling, tanning, and the making of furniture.

It was founded in 1764, and named Angostura for its location on the narrowest point of the Orinoco. It played a major part in the struggle for independence. It was the site of the Congress of Angostura held in 1819, which, under Simón Bolívar, formed the Republic of Colombia out of the Spanish states of New Granada and Venezuela. Pop. (1941 est.) 19,764.

CIUDAD DE CURA. See VILLA DE CURA.

CIUDAD JUAREZ, syōō-thāth' hwā'rās, city, Mexico, on the Rio Grande opposite El Paso, Tex. (with which it is connected by an international bridge), in the state of Chihuahua. It was founded late in the 17th century. Formerly known as EL PASO DEL NORTE, it was renamed in 1888 for Benito Juárez, who found refuge here while most of Mexico was occupied by the French. Pop. (1940) 48,881.

CIUDAD PORFIRIO DIAZ. See PIEDRAS NEGRAS.

CIUDAD REAL, thyōō-thāth' rrē-āl', city, Spain, capital of Ciudad Real Province (7,620 square miles), near the Guadiana River, 99 miles south of Madrid. The notable Gothic cathedral of Santa Maria del Prado has only a single nave. Woolen and linen textiles and brandies are manufactured. Alfonso X (el Sabio) founded the town, which was known as Villareal until 1420. Near here, on March 27, 1809, the Spaniards were defeated by a French force. Pop. province, (1941 est.) 535,981; city, (1941 est.) 32,931.

CIUDAD RODRIGO, thyōō-thāth' rrō-thrē'gō, city, Spain, in Salamanca Province, on the Agueda River, 53 miles west-southwest of Salamanca. The cathedral, begun in 1190, has numerous interesting features. The city was occupied by the British in 1706-1707, during the War of the Spanish Succession; it was captured by the French under Gen. Michel Ney on July 10, 1810, and was taken once more by the British, under Viscount Wellington, on Jan. 19, 1812. For this success Wellington received an English earldom, and the Spanish Cortes bestowed upon him the title of duke of Ciudad Rodrigo. Pop. (1941 est.) 12,082.

CIUDAD TRUJILLO, syōō-thāth' trōō-hē'yō, capital of the Dominican Republic, is a

seaport on the south coast at the mouth of the Ozama River; until 1936 it was known as SANTO DOMINGO. The oldest continuous European settlement in the Americas, it was founded in 1496 by Bartholomew Columbus, brother of Christopher Columbus; a tomb in the Gothic cathedral (commenced in 1514) is said to contain the remains of the latter. Pop. (1948 est.) 147,372.

CIUDAD VICTORIA, syō-thāth' vēk-tō'-ryā, town, Mexico, capital of the state of Tamaulipas, 150 miles southeast of Monterrey. The town, founded in 1750, is the center of a sugar-growing region. Pop. (1940) 19,513.

CIVET, a family of small carnivorous mammals, the Viverridae, related to both the hyenas and the cats. Their alliance to the former appears when the fossil history of the family is traced back to the early Tertiary, where the ancestry of both converges. The comparatively coarse hair and erectile mane possessed by some species, and dentition, are still hyenelike; while the slender, elongated form, long tail, and, especially, the fact that the claws are semiretractile, exhibit the inborn likeness to the cats. The civets vary from two to three feet in length, and most of the species are strongly marked in black and white stripes and spots, sometimes prettily disposed. They are distributed throughout the warmer parts of the Old World. The family is divisible into two groups, one of which includes the typical civets; the African genets, one species of which also inhabits Spain and Italy; the linsangs and other Oriental spotted forms, and the paradoxures. The second group includes the mongoose and other ichneumons, suricates, and the like. These various forms will be found described elsewhere under their separate names.

Civets feed upon smaller mammals, birds' eggs, lizards, and snakes, and are considered beneficial because of their appetite for crocodile eggs, which they devour in great quantities along the Nile. They are characterized by, and chiefly valued for, an odorous, fatty substance, contained in a pouch connected with the sexual organs, in both sexes. This substance is used for compounding perfumes, and is ready for use after it has been drained, washed, and dried. It is called "civet." A dram is obtained at a time from each animal, from which it is taken at intervals of a few days.

CIVIC CROWN, among the Romans, the highest military reward assigned to him who had preserved the life of a citizen in battle. It bore the inscription *Ob civem servatum*, that is, "for saving a citizen," and was made of oak leaves. He who was rescued offered it, at the command of his leader, to his preserver, whom he was bound to honor afterward as a father. Under the emperors it was bestowed only by them.

CIVICS AND CIVICS TEACHING. Originally civics was concerned with government and the relations of citizens to government at its various levels. During the 20th century the term has broadened to include all aspects of citizenship: political, economic and vocational, social and ethical. School courses in civics, recently often named Citizenship, are now likely to include some aspects of psychology, attention to individual growth and adjustment, the role of

the individual in groups of all kinds, aspects of social psychology, including intergroup relations, and aspects of international organization and cooperation. School courses in civics accordingly have become offerings in general social studies, drawing not on government alone but on many social sciences. Increasingly they reflect the philosophy of general education—concern, that is, for the well-rounded development of every human being as well as for his growth in civic competence.

Much civic education in the United States has always been informal and gained outside school. In colonial times it was carried on in home and church, in election sermons and such newspapers as were published, at militia drills and in taverns—wherever men gathered. Through successive generations the greater and the more influential part of political education has gone on near the cracker barrel and street corner, in holiday observances and political rallies, in town meetings and in contacts with the local boss, in the gatherings of patriotic and civic organizations of both sexes and all age groups, in the press, the movies, and radio and television programs. Family background, including its nation of origin, economic interests and pressures, social status, and religious affiliation have all been significant in informal teaching of civics.

Explicit attention in schools to political education began very soon after the formation of the Federal Union. Textbooks both in American history and in government date from the early 1790's, though their use spread slowly. School readers, like the series edited by McGuffey, included much attention to heroes, dramatic episodes in history, and standards of personal and civic behavior. Until 1865 textbooks in American history reflected considerable sectionalism, though national and nationalistic attitudes gained steadily.

As public elementary schools were established from the 1820's on, American history, then predominantly political, constitutional, and military, became a standard part of their curriculum. The same was true of high schools, also first established in the 1820's, though their great growth has been since 1870. Nationalism and some realization of need for attention to the Americanization of immigrants stimulated local authorities to make national history, with its emphasis on the Constitution, political events, and American traditions and ideals, a requirement in the intermediate grades, again in the grammar grades (now included in junior high schools where these have been established), and for a third time in high school. Some colleges have required still another survey. Such requirements have been reinforced by legislation in more than half of the states and by the admissions requirements of colleges. Many states have also required the teaching of state history and government. Incidental, but far from negligible, contributions to civic education have been made by courses in ancient and English history (now merged in world history), in some literature read in English courses, and in school assembly exercises and observance of holidays.

Courses in civics or government alone have never received as much attention, either in time or explicit requirements, as has American history. Continuous and slowly increasing publication of textbooks on the Constitution or civil government indicates some school use of them through the 19th century. Their content, and the classroom

teaching based upon them, rarely went beyond factual data, mostly concerning the federal government, which pupils were expected to memorize. The flood of immigration, the extension of the franchise and democratic rights, and the appearance of organizations of professional educators, historians and political scientists resulted in demands for more systematic political education. A long series of investigations and reports sponsored by the National Education Association (1893, 1913, 1916), the American Historical Association (1899, 1908, 1911), the American Political Science Association (1908, 1916), the National Municipal League (1901, colleges; 1905, high schools; 1914), various regional organizations of history teachers, and the Federal Bureau (now Office of Education) resulted in more teaching of civics and broader concepts of its scope. The influential reports of the American Historical Association stimulated the allocation of at least one fifth of the class time in American history, in both grades eight and twelve, to study of American government; separate textbooks were usually provided. The College Entrance Examination Board reinforced the attention to civics by setting an examination on the combined fields of American history and civil government. Both the American Historical Association (1908) and the American Political Science Association (1908) urged attention to governments of town and city, state and nation, in the intermediate grades; the former believed that "elementary civics should permeate the entire school life of the child."

The American Political Science Association in both 1908 and 1916 recommended that a half-year course, or equivalent, in American government be offered in senior year of high school. The recommendation has been followed in many communities, especially since 1916 when American history began to be placed in grade eleven rather than twelve. The 1908 report also gave attention to teacher education, library resources of high schools, and the need for firsthand observation of government in operation and for reading newspapers and magazines. The report concurred in the view vigorously advanced by the National Municipal League, from 1901 on, that major attention be devoted to local and state government, both of which are closer to the citizen than is the national government. It reflected professional developments in the field of education, as well as a broadened concept of civics, in its attention to aims, social service, teaching methods and devices, and practice of active and responsible citizenship.

The 1913 and 1916 reports of the Committee on the Social Studies of the National Education Association's Commission on the Reorganization of Secondary Education set the pattern for social studies courses in grades seven through twelve that has since been most commonly followed. The reports emphasized effective citizenship as the central objective of all social studies instruction, to which geography and American history in grades seven and eight, a new full-year course in civics in grade nine, world history in grade ten, American history in grade eleven, and either a new full-year course in problems of American democracy or separate half-year courses in government, economics, and sociology in grade twelve, should all contribute.

The courses for grades nine and twelve, both as outlined in the reports and as they have de-

veloped in schools, reflect broadening concepts both of social studies and of civics. Recommendations of community civics and vocational civics for grade nine have continued to be influential, though guidance officers have increasingly taken responsibility for the vocational area. Textbooks and courses in economic civics, social civics, and citizenship have not neglected government and political citizenship, but have given attention as well to the role and responsibilities of all individuals in economic life, both as producers and consumers, and in social relationships, both as individuals and as members of many social groups. The same has been true of the grade twelve course in problems of American democracy (or problems of democracy or modern problems). Tables of contents of textbooks for the two grades, and topics or units listed in courses of study, have come to be very similar. Both courses draw on the fields of government, including international relations, economics, sociology, psychology, and social psychology, though boundary lines between the various subjects have become less and less distinct. Both offerings overlap the rapidly developing field of guidance in their attention to better individual adjustment. Both stress recent and contemporary affairs, as is true of courses in American and world history. Moreover, in all social studies classes, beginning with grade four, one period a week or the equivalent is likely to be devoted to current events; several weekly magazines published for the intermediate, the junior high school, and the senior high school grades are widely used, and some daily newspapers and adult weeklies publish study and teaching materials for classroom use.

The half-year course in government has by no means disappeared from grade twelve. It puts less emphasis, however, on encyclopedic information concerning forms of government and more on the purposes, functioning, and services of government, together with the responsibility of individuals for making democracy effective.

All courses concerned with civics have tried to relate their treatment to the firsthand experience of learners, to expand that experience through guided observation, and to encourage activities that involve participation in community affairs, youth organizations, and the conduct of classroom and school life. Many schools have sponsored trips to town meetings, other local and state legislative sessions, courts, banks and retail establishments, factories and assembly lines, and a variety of governmental, social, and civic-centered agencies. Some schools have deliberately expanded the powers of student-government organizations and student councils, encouraged such programs as those of the Hi-Y, 4H Clubs, the Junior Red Cross and Red Feather (Community Chest) agencies, and a variety of relief projects. They have cooperated in essay and other contests designed to promote patriotism, understanding of American traditions and ideals, and international understanding and cooperation. They have sponsored various community surveys and projects for community improvement.

Many organizations have concerned themselves with the subject matter and attitudes involved in education for citizenship. The Daughters of the American Revolution, the Sons of the American Revolution, the Grand Army of the Republic, the Confederate Veterans and United Daughters of the Confederacy, the American Legion, Irish-Americans, German-Americans, Polish-Ameri-

cans, Italian-Americans, Negro groups, the American Bar Association, the American Manufacturers' Association, the United States Chamber of Commerce, the American Federation of Labor, the Rotary Clubs and Kiwanis, the Knights of Columbus, the Masons and De Molay, the League of Nations Association and the United Nations Association, and a range of agencies of the federal government, in time both of war and peace, have urged attention to information or attitudes of special concern to them or have published materials for school use.

The rise of totalitarian governments and the coming of World War II stimulated review and improvement of the school program in civics and citizenship. Professor Charles E. Merriam edited a ten-volume series entitled *Studies in the Making of Citizens* and wrote the summary volume, *A Comparative Study of Methods of Civic Training*, (University of Chicago Press, Chicago 1931); the countries studied were Soviet Russia, Great Britain, the Habsburg Monarchy, Italy, Switzerland, the United States, and France; another volume was anthropological in approach. The Educational Policies Commission sponsored a study of better practices in American schools, published in 1940 under the title *Learning the Ways of Democracy*, and also published volumes concerned with economic citizenship, school administration in relation to democracy, social services, and moral and spiritual values in public education, together with a series of pamphlets for teacher and pupil use. The National Council for the Social Studies has devoted many publications and convention programs to aspects of the teaching of government and citizenship; the publications include a yearbook, edited by R. W. Crary, on *Democratic Citizenship Education* (1952). Other organizations of professional educators have been notably concerned with the broadening and deepening of the school program in citizenship.

In the years following World War II, numerous grants by foundations made possible systematic attacks on problems in civic education. The Civic Education Project (Cambridge, Mass.) undertook the writing and publication of attractive and readable booklets to fill a gap in teaching resources. The Detroit Citizenship Education Study investigated the behavior of children in a variety of environments, analyzed school experiences related to growth in citizenship, and developed a program involving school cooperation with parents, governmental and voluntary agencies, and representative citizens. The Citizenship Education Project at Teachers College, Columbia University, developed a cooperative program with school systems and teacher-education institutions in all parts of the nation; the project set out to identify and extend the use of more promising practices, to aid teachers in locating needed resources, to provide some new materials, and to improve ways of evaluating results.

Elementary as well as secondary schools have participated in developing school and community experiences that advance civic understanding and responsibility. The social studies program in primary grades helps children understand the home and community. Neither the primary nor the intermediate grades attempt to teach civics or government as such, but do attempt to develop understanding of social, economic, and political life insofar as the experience and maturity of pupils permit.

College offerings in government or political

science have been multiplying since the late 19th century. Fewer college requirements have been established in American government than in American history, but registrations in government offerings have been numerous in four-year colleges and junior colleges, and most undergraduates preparing to teach social studies in high school have been required to include at least a year of government in their program. Reports of the American Political Science Association have repeatedly stressed the value of offerings in American government, state government, and comparative government both in general education and teacher education. A few colleges, at least, have experimented with trips planned to provide opportunity for observation of government in action. Following World War II Dartmouth College instituted a course in Great Issues, required of all seniors, which is still unusual in its recognition of the responsibility of colleges in the education of undergraduates for competent democratic citizenship.

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ERLING M. HUNT,
Teachers College, Columbia University.

CIVIDALE DEL FRIULI, chë-vê-dâ'lâ dâl frê'ôo-lê, (ancient FORUM JULII), town, Udine province, Italy, 9 miles east by northeast from the town of Udine. It consists of the town proper, surrounded by walls and ditches, and of fine suburbs; and has among its edifices a large cathedral of the 15th century, with three Gothic portals, a curious baptismal font and several fine paintings; a museum of antiquities, and a record office with some very ancient characters. The neighborhood abounds in interesting antiquities. The Natisone, which flows through the city, is crossed by a 15th century bridge. The modernized city has a military training college, and silk, cotton and linen factories. Pop. (1936) 4,715.

CIVIL ACTION, an action brought in the civil courts for the recovery or protection of private or civil rights, or damages for their breach. The two great classes into which actions are divided are civil and criminal. In civil actions either a government or a private individual may be plaintiff or defendant; while criminal actions are always brought in the name of the government.

CIVIL AERONAUTICS ADMINISTRATION, a bureau of the United States Department of Commerce. The Civil Aeronautics Act of 1938 created the Civil Aeronautics Authority, a successor to the Bureau of Air Commerce. As a result of reorganizations, the authority now exists only on paper. It is more accurate to refer to its two main parts, the Civil Aeronautics Administration and the Civil Aeronautics Board, a separate and independent organization (see CIVIL AERONAUTICS BOARD).

The administrator of civil aeronautics encourages and fosters the development of civil

aeronautics and air commerce; encourages the establishment of civil airways, landing areas, and other air navigation aids and facilities; designates and establishes federal airways; acquires, establishes, operates, and maintains air navigation facilities along civil airways and at landing areas; makes provision for the control and protection of air traffic moving in air commerce; undertakes or supervises technical development work in the field of aeronautics; and plans for the development of aeronautical facilities. The administrator also carries out civil aeronautics safety regulations (except the prescribing of safety standards, rules and regulations and the suspension and revocation of certificates after hearing), including effectuation of safety standards, rules and regulations; examination, inspection, or rating of airmen, aircraft, aircraft engines, propellers, appliances, air carriers, air navigation facilities, and air agencies; the issuance of emergency suspension of safety certificates, provides for aircraft registration and recording of title; recommends to the Civil Aeronautics Board proposed standards, rules and regulations designed to promote air safety; requires notice with respect to hazards to air commerce; and administers the affairs of the Washington National Airport. The administrator of civil aeronautics is appointed by the president with the approval of the Senate.

CIVIL AERONAUTICS BOARD, a board which performs its functions independently of the secretary of commerce of the United States. It is composed of five members, appointed by the president with the approval of the Senate, one of whom is annually designated by the president as chairman and another as vice-chairman. Not more than three members may be of the same political party. The board exercises the powers, mostly of a quasi-legislative and quasi-judicial nature, which have been conferred on it as a result of the Civil Aeronautics Act of 1938 as modified by Reorganization Plans 3 and 4. The board prescribes safety standards, rules, and regulations and has the power to suspend and revoke safety certificates after hearing; it issues, among other things, certificates of public convenience and necessity to air carriers and permits to foreign air carriers; regulates rates for the carriage of persons and property; prescribes rates of compensation for the carriage of mail. The board makes rules on notification and report of accidents involving aircraft; investigates such accidents and reports the facts, circumstances, and probable causes; makes its reports and recommendations public in such manner as it deems to be in the public interest.

CIVIL CORPORATIONS. See CORPORATIONS, LEGAL.

CIVIL DAMAGE ACTS, legislative acts passed in several of the states, giving to husbands, wives, children, parents, guardians, employers, and others who have sustained injury in person or property or means of support, by an intoxicated person in consequence of such intoxication, the right of action against the person who sold or gave away the liquor which caused such intoxication. Such acts have been held to be constitutional. In some cases the right of action has been extended to the owner of the premises where such intoxicating liquor has been obtained.

CIVIL DEATH, a legal term applied to a person who, on account of some crime, has been convicted and sentenced to life imprisonment, thereby losing all his civil rights, and is considered in law, dead. In some jurisdictions a person convicted of murder and sentenced to life imprisonment is considered in law as dead.

CIVIL DEFENSE, the protection of the home front by civilians acting under civil authority to minimize casualties and war damage and preserve maximum civilian support of the war effort. It rests upon the principle of self-protection by the individual, extended to include mutual self-protection on the part of groups and communities. Manned largely by unpaid part-time volunteers, each service of civil defense acts in cooperation with the others for the common good.

Preliminary Conceptions.—American civil defense activities during World War I did little more than bolster morale. During World War II, the Office of Civilian Defense (OCD) and civil defense agencies on the state and local levels were assigned duties and functions of the vaguest sort. With the policies and plans being channeled down through regional OCD offices, various protective activities emerged on the local level, but the War Department Civil Defense Board estimated in 1948 that the OCD effort would have been totally unable to cope with heavy enemy raids.

Prior to World War II, England organized a civil defense program which gave the people a plan for action. Japan did not believe that attacks would reach her shores and was ill-prepared in civil defense procedures and facilities. Germany had only a partial conception of the needs and was hampered by administrative muddles.

In Canada the problems of civil defense were very different from those in countries like England or Germany with dense populations, relatively small areas and much shorter distances from possible enemy bases. With its three and a half million square miles, Canada is one of the largest countries in the world and yet has less than 15 million people. It is some thousands of miles away from Europe or the Far East. Alaska, the only part of the continent close to Russia, is in the hands of the United States. Hence Canada is just as much interested in the defense of Alaska as is the United States in the defense of every part of Canada. Common interest dictates that they work together.

On March 27, 1951 the two countries effected a civil defense mutual aid agreement, and one month later held the first meeting of the Joint United States-Canadian Civil Defense Committee in Washington, D.C. Their discussions included such important matters as medical health, special weapons defense and emergency welfare, entry of civil defense forces and materials of one country into the other, training, standardization and interchange of equipment, communications and warning systems, state-province civil defense mutual aid agreements, and public affairs.

Present United States Civil Defense Organizations.—The Federal Defense Act of 1950 authorized a federal civil defense program for the United States. It was approved by the president on Jan. 12, 1951. A digest of the act follows:

The Federal Civil Defense Administration was created to formulate a plan to protect the people of the United States and their property from the effects of attack. The states and their political

subdivisions are responsible for civil defense, with the federal government providing guidance, coordination, and assistance.

The act establishes the Federal Civil Defense Administration as an independent agency within the executive branch of the government, and provides for the appointment of an administrator and a deputy administrator from civilian life.

It creates a Civil Defense Advisory Council of 12 representatives of federal, state, and local governments which shall meet at least once a year to advise the administrator on policy.

The administrator is authorized to develop plans and programs for civil defense; obtain reports from the states on the status of civil defense; coordinate the civil defense activities of federal departments and agencies; provide for the dissemination of attack warnings; make studies on methods dealing with effects of attacks; develop shelter designs and protective materials; standardize specifications for civil defense requirements; disseminate information through press, television, radio, and other means; assist and encourage the states to enter into mutual aid arrangements with each other and with neighboring countries; procure property and materials needed for civil defense, by purchase or condemnation; establish one staff college and not more than three technical training schools; prescribe the official civil defense insignia and some regulations covering its manufacture and use. The administrator also is authorized to make contributions to the states for approved civil defense projects. Such contributions may not be used for state or local personnel and administrative expenses, or procurement of land. Contributions for organization equipment or shelters must be matched equally by the different states.

On the declaration of a state of civil defense emergency by Congress or the president, the latter may direct federal agencies to provide their personnel, materials, and facilities to the administrator for the aid of the states. Under the coordination and direction of the administrator, such agencies will provide emergency shelters, facilities, and services, and make emergency repairs to essential facilities.

The administrator may also: procure, sell, lease, lend, transfer, or deliver property needed for civil defense; reimburse any state for compensation and other expenses paid to its civil defense workers serving beyond the borders of that state, and for materials utilized or consumed outside the state; give financial aid to civilians injured or in want because of an attack; and employ additional personnel without regard to civil service laws.

The act provides procedures for the payment of fair compensation for property acquired and for its return when no longer needed.

The title General Provisions provides the normal administrative authorities and in addition authorizes the administrator to utilize the facilities and resources of federal agencies and, with their consent, those of state and local governments; accept, use, or distribute gifts of supplies, equipment, and facilities; and authorize the states to organize individuals and organizations into units to be known collectively as the United States Civil Defense Corps, but members of the corps shall not by reason of such membership in the corps be regarded as federal employees.

The Reconstruction Finance Corporation is authorized to make loans, not to exceed \$250,000,000 at any one time, for projects certified by the

administration as necessary for the civil defense program.

Canada.—The present civil defense organization of Canada was established in 1948. Matters of major policy with regard to federal responsibility for civil defense are decided, subject to the control of Parliament, by the cabinet and the Cabinet Defence Committee. The minister of national health and welfare is responsible for planning and coordination and deals directly with provincial authorities. The cabinet and the minister are advised by the Chiefs of Staff Committee on questions of strategy as they bear upon the problems of civil defense. The chiefs of staff are responsible to the minister for directing participation of the armed forces in civil defense, where that becomes necessary.

The civil defense co-ordinator, responsible to the minister, is chairman of the Civil Defence Co-ordinating Committee and coordinates federal planning and action, while maintaining liaison with corresponding agencies in the United Kingdom, the United States and other countries. The Civil Defence Co-ordinating Committee has as permanent members representatives of the departments of Finance, National Health and Welfare, Public Works, Resources and Development, Trade and Commerce, Transport, Labor and Agriculture, as well as the Royal Canadian Mounted Police. The committee includes as well the secretary of the Chiefs of Staff Committee and the Dominion fire commissioner. Representatives of agencies such as the National Research Council and the Atomic Energy Control Board are called in when matters affecting them are discussed.

The Defence Research Board advises the minister, the armed services, and the civil defense co-ordinator on scientific developments in this and other countries applicable to civil defense.

Federal activities include organization within federal departments, the armed forces and other federal agencies; arrangements for coordination with provincial and local authorities; information to the provinces regarding general policy; co-operation and coordination with the United States and other countries; operation of a central training school for civil defense specialists; setting up of a warning system in cooperation with provincial and local authorities and agencies; protection of federal works against sabotage; research on civil defense, and providing equipment needed especially for civil defense over and above that required for ordinary peacetime purposes under terms and in accordance with arrangements worked out from time to time with the provinces.

Under the Canadian constitution a very considerable number of matters bearing on civil defense—fire fighting, police, administration of justice, municipalities, etc.—fall under the jurisdiction of the provinces, which have complete control of their own civil defense organizations. The following indications of possible lines of provincial activity may result from discussions between officials of the federal government and the provinces:

Provincial organization began with the appointment by every province of a minister or official with whom federal authorities might communicate regarding matters requiring provincial action.

According to the requirements of the province, the provincial authority might set up a committee with representation which might include other provincial departments concerned, such as Health,

Public Works, Provincial Police; the municipalities; public utility, transportation, and communication services; hospital and welfare service; and national and other organizations working within the provinces.

If desired, representatives of the armed services and the Royal Canadian Mounted Police may be detailed to work with the provincial authority for purposes of advice and liaison. The provincial authority deals with such matters as organization of municipalities for which civil defense is considered necessary; coordination of services of adjacent municipalities; provision of information to municipalities and other agencies operating within the provinces; training within the province; assistance to municipalities in meeting civil disaster; protection against sabotage of provincial services and advice on methods of protecting municipal and privately owned services; and insofar as lies within provincial authority, providing the necessary legislation to permit the local authorities to operate.

In each municipality in which the provincial authorities consider that there is a need for a civil defense organization, or where the municipality itself desires it, the local authority may initiate the necessary action. All available resources must be used to minimize the effects of a possible attack.

United Kingdom.—In Great Britain, under the Civil Defence Act, 1948, the postwar organization, formation, and training of civil defense forces were provided for. In March of that year the Civil Defence Joint Planning Staff was set up, and, by autumn, planning had reached the stage at which a practical program of civil defense could be put into effect. The year which elapsed between the passing of the act and the beginning of recruitment in November 1949 was largely spent in working out a system which would give the greatest possible control to the local authorities responsible for the following program:

Organization.—Volunteers are eligible for service in four units as follows:

Civil Defence Corps: organized in divisions, each responsible to a local authority, and subdivided into six sections: (1) Headquarters; communications; special reconnaissance; public information and administrative centers; identification of toxic agents. (2) Warden: supplementary air-raid warnings; incident control; movement of refugees; reconnaissance and reporting; organization of domestic self-help parties. (3) Rescue: rescue work; stretcher bearing; first aid. (4) Ambulance: ambulance driving and first aid. (5) Pioneer: debris clearance; demolition; decontamination of highways, vehicles, and clothing; cleaning of uninjured persons; stretcherbearing; salvage; emergency repairs to houses and utility services; road clearance. (6) Welfare: escort and welfare of homeless and evacuees; billeting; rest centers; supervision and welfare of public in shelters; emergency cooking and feeding; mobile kitchens and canteens; replacement of clothing; veterinary service.

Auxiliary Fire Service: organized in units of the regular force.

Special Constabulary: organized in the units of the regular force, special constables are asked to help the regular police in peace as well as in war.

National Hospital Service Reserve: limited to trained nurses and persons willing to train as nursing auxiliaries.

Training of Instructors.—Full-time instructors are trained in the latest defense methods at Home Office training schools, and thereafter conduct classes for volunteers in the evening and on week ends. The training of instructors includes courses on the effects of atomic explosions and the use of Geiger counters and pocket electroscopes to detect and measure harmful radiations. There are three Home Office training schools: at Falfield, Gloucester; at Easingwold, Yorkshire, and at Taymouth Castle, Perthshire, Scotland.

In addition to these schools, the Home Office maintains a Civil Defence Staff College at Sunningdale Park, Berkshire. The charter of the staff college provides for "training and study in all aspects of the higher direction of civil defence operations, including post-raid and restoration activities, for senior officers and officials of all services and organizations concerned in this part of the national defence system." The first of the four-week courses at the staff college enrolled 30 students, including civil defense heads and chiefs of police, from Britain, Malaya, and Gibraltar.

Royal Observer Corps.—Volunteers are also being recruited for the Royal Observer Corps. A training program for volunteers was inaugurated in 1950 which includes practice plotting, aircraft reconnaissance, and cooperation exercises with the Royal Air Force. Observers sign on for three years, and receive small annual grants with additional emoluments for traveling expenses and for passing efficiency tests. Volunteers must be between 16 and 55 years of age. The corps works on a post and center system covering five areas of the United Kingdom: Southern, Midland, Western, Northwestern, and Scottish.

Cooperation between the armed forces and the civil authorities in civil defense problems was studied in 1949, in two exercises of a consultation nature, and served to lay the foundations of civil and military liaison in civil defense problems.

Reorganized home defense in Britain by mid-1950 was only in a preliminary stage. More volunteers were needed, and the necessity for preparation and training during peacetime was stressed during the recruiting campaigns.

Detailed guidance also has been furnished to local authorities in leaflets and pamphlets.

Recruitment.—Recruits do not enroll for a fixed period of service, but are expected to continue in the Civil Defence Corps as long as they are able, and, in the event of war, will be given opportunities for full-time service. Recruits may transfer, where practicable, from one section to another but they are not compelled to serve away from home. No payment for service is made, but members are reimbursed for reasonable out-of-pocket expenses. Training in most sections averages four or five hours a month, for a total of 50 to 60 hours. Badges are issued to recruits who have completed their first ten hours of training.

T. P. HEADEN,
*Director, Publications Division, Public Affairs
Office, Federal Civil Defense Administration.*

CIVIL ENGINEERING. While the designation civil engineering dates back only two centuries, the profession of civil engineering is as old as civilized life. All through ancient times it formed part of a broader profession, best

described as that of the master builder, which included the branches now known as architecture and both civil and military engineering. Under the earliest Egyptian dynasty, 3000 to 3100 B.C., the title "chief of works" appears; and the master builder was busily engaged in carrying out those great constructions, pyramids, temples, and early irrigation developments still regarded as among the greatest works of man.

When Greece became the leading power in the eastern Mediterranean, new problems of urban life arose, notably public water supply and harbor constructions, while the temple constructions of Greece reflect a clearer understanding of the mechanics of construction as well as new standards of esthetic design. The interest of the Egyptians was in "how" rather than "why," but under the Greeks a truly scientific technique of design and construction began to develop. This evolution is reflected in the use of the title *architekton*, or architectonician, from which the present profession of architecture takes its name, but which at that time included all types of construction activities.

Similarly, the Roman *architectus* was engaged not only in the design and construction of public and other buildings but also in the many public works of the day, aqueducts, bridges, streets and highways, harbors, and drainage projects.

With the collapse of the Western Roman Empire, the public demand for such works no longer existed, and Western civilization struggled through the Dark and Middle Ages to a rebirth of civilized life which we carry forward today. It was inevitable that the modern world, born among the ruins of Roman civilization, should in the earlier stages base its constructions on Roman examples. In architecture this movement was reflected in the Romanesque style of the early Christian churches and monastic buildings. In engineering, the most notable examples are found in those bridges of the Middle Ages which have survived the ravages of floods and man. These works were clearly inspired by earlier Roman constructions.

While the engineering works of the Middle Ages were widely scattered in western Europe, for example the Old London Bridge (erected 1209 and replaced 1823), the Pont Valentre at Cahors (1355), and the Pont St. Benezet at Avignon, France (1187), it was in northern Italy that the revival in engineering as well as in art and literature first reached a new stage. It is probable that the modern canal lock was developed in Italy; a new form of masonry arch bridge, the segmental arch, was also an Italian product; and in the new era of military engineering Italian engineers were recognized as leaders. It was in the 16th century, following the French-Italian wars, that these developments were carried from Italy to France and became a basis on which French engineers established a leadership which was retained all through the 17th and 18th centuries. One of the most important and interesting of these developments was that of military engineering.

The Middle Ages had given birth to the feudal system, to control by independent petty nobles for whom the feudal castle, at once a home and a fortress, was developed. It is in connection with this field, the work of the military expert and builder who improved the ancient means of offense, the catapult, battering-ram, and similar devices of ancient times, and devised as a defense the medieval castle with its

moat, drawbridges, massive walls, and keep, that the terms engineer and engine first appear.

Tertullian, a father of the Latin Church, about 200 A.D., in writing earlier Roman history, described the Carthaginians as being dumfounded when the Romans attacked and brought up a battering-ram, a new and extraordinary *ingenium*. The Latin *ingenium* (wit) was thus first applied to a product of genius, an engine. After a lapse of almost a thousand years, the builder or manipulator of an *ingenium* became known as an *ingeniator*, or engineer.

This new title received wider recognition and application following the advent of gunpowder and the cannon in the 13th and 14th centuries. It has been characteristic of engineering that the rise of a new technique, unrelated to older practice, has given birth to new branches of this ancient profession. The new method of offense introduced new problems, such as the making of cannon, the factors involved in the trajectory of cannon balls, and also gave an impetus to military surveying which led to a host of texts on this subject—the first great flood of engineering books. This new weapon also rendered the medieval castle obsolete and led to the design of a new type of structure, the earthwork fortification. These new techniques, unrelated to the older activities of the master builder, brought about the separation of military activities as a specialty under the title of military engineering.

During the period usually referred to as the Renaissance, the situation was thus somewhat confusing, in that one man, such as Leonardo da Vinci (q.v.), might practice as an architect, as a military engineer, and also as a hydraulic expert. Of civil engineering, in the modern sense, however, there was little, for the master builder of the day, as in the Middle Ages, was precariously attached in a private capacity to one of the many military leaders or nobles. There was little or no demand for public works.

As such a demand gradually developed with the collapse of the feudal order and the rise of nationalism, the need for bridges, water supplies, canals, and other works was met not only by the architects or military engineers of the day but through the activities and skill of ingenious men drawn from other walks of life, such as Sir Hugh Myddelton (1557?–1631, q.v.) in England, the goldsmith who built the New River water supply for London in 1609, or Pierre Paul Riquet (1604–1680), in France, the tax collector and builder of the Canal du Midi (1680). It was John Smeaton (1724–1792, q.v.), of Eddystone Lighthouse fame, who, about 1750, first used the term civil engineer to distinguish his field from that of the military worker. On the other hand, the great French engineers, who were the engineering leaders of the 18th century, still retained a close liaison with the architects, and were members not only of the Corps des Ponts et Chaussées but also of the Institute of Architects.

With the development of steam power in Great Britain during the late 18th century and the chaos in Europe following the Napoleonic wars, engineering leadership passed to Britain, the home of the steam engine, the steam locomotive and railroad, of the modern era of iron and, later, steel, and of the first widespread application of this new power in industry. Here again a new technique was introduced which ultimately led to the birth of another engineering branch, mechanical engineering. Civil engineers, usually with mill-

wright training as a background, carried on this profession until it was clearly recognized as a separate field through the establishment of the Institution of Mechanical Engineers in Great Britain in 1847.

These developments in engineering were also influential in bringing about the separation of the work of the construction expert into the two professions now known as architecture and civil engineering. The architect, on the one hand, emphasized the esthetic element in design and confined his activities to buildings and monuments, those works in which this element dominated. The engineer, on the other hand, began to develop a more highly rationalized, scientific technique of design which, progressively, relied less and less on tradition, intuition, and appearance, the factors which controlled the work of the architect.

This movement to reduce engineering to a science stemmed from the French Revolution, but was first carried forward in its practical applications in Great Britain. The works of the Scottish engineer and physicist, William John Macquorn Rankine (1820-1872, q.v.), notably his *Manual of Applied Mechanics* (1858), *Manual of Civil Engineering* (1861), and *Manual of the Steam Engine* (1859), summarized these advances and were a milestone in this development. With this change, the divorce between engineering and architecture not only became complete but a new engineering era was born.

Needless to say, various methods of design and calculation had been developed in engineering from time to time, but the modern evolution of structural mechanics, and later of machine design and of practical thermodynamics, led to the more accurate proportioning of structures and machines in accordance with their proposed functions and the loads they had to bear. The effects of this change in technique were widespread. It led to a more effective and more economical utilization of materials. A new impetus was given to the ancient urge to secure the most effective and efficient design, still the fundamental factor in the constant advance in technical methods and design. Such exact and complete understanding was also essential to the growth in size and scope of engineering undertakings of modern times. But the reduction of many of the procedures of engineering to well-rationalized routines also made possible an age of widespread engineering development. The older practice, relying almost entirely on an intuitive engineering sense developed and matured through experience, was limited to those few and rare individuals who possessed such personal gifts. The new techniques could not only be taught to many who were not so fortunately gifted, but could also be more effectively imparted through the formal processes of the classroom than through the older method of apprenticeship. This change is strikingly reflected in the growth of American engineering schools. Before 1850 there were only three such schools in the United States, whereas, by 1870, there were 70. (In 1945 the total number of accredited schools was about 125.)

The new era did not come into being without protests from the so-called practical man, but the formal education of the engineer has now become so well recognized that graduation from an accredited school is practically essential to securing the necessary license (now required by almost all the states) for practice as a professional

engineer. Furthermore, the modern engineering school, born of the scientific movement in engineering and often called a scientific school, still occupies a position of leadership in the continued search for improved products, processes and methods, and for the further rationalization in design, through research and graduate instruction.

Modern Trends and Relationships.—The position of the engineer in the life of his day has varied greatly throughout the long history of the profession. In ancient Egypt the master builder became one of the highest nobles of the royal court, planning and actively directing a host of subordinate officials in the construction of the royal tombs and great temples, as well as being responsible for the economy of the country, the surplus of which made possible the great but useless royal works of this long era. It is notable, however, that Egyptian economics and political life became firmly established in fixed forms in the earliest days of the pyramid age and that there were no important developments in technical methods or design after that period; in fact, the quality of Egyptian construction steadily deteriorated. While Egypt had the organized authority essential to great public constructions, and a large population to be served by such works, this economy was exploited in the interests of the rulers and priesthood, and an incentive to continued technological development was lacking.

In Greece, on the other hand, while scientific inquiry was encouraged, the emphasis was placed on art, literature, and philosophy rather than on useful applications, and the Greek city-states were never able to secure that degree of political unity essential to widespread engineering development. The notable contributions of Greece to technical development must not be minimized, for Greek technology was basic to all the work of Roman and later master builders. But the economic and political atmosphere of Greece was unfavorable to engineering progress, and, accordingly, retarded a most promising technical growth and development.

The Greek *architecton* appears to have occupied a relatively unimportant position in the life of his day unless he happened to be connected with the building of public temples or other works of art. Under Roman rule, on the contrary, the work of the master builder was considered of primary importance. While the Romans contributed road building, the development of the masonry *vousoir* arch, and a widespread use of cement, they lacked the inquiring mind which we regard as typical of the Greeks. Very little new technical knowledge was added by Rome to the accumulations of earlier centuries. Yet Roman civilization spread throughout the ancient world and wherever Roman armies went, sooner or later Roman constructions followed—Roman roads and aqueducts were built from Spain to Asia Minor, from North Africa to Britain. The real promoters and planners of these works were the leading public officials of the day, while the details were left to numerous petty officers and technicians. The modern engineer thus finds in Roman rule a remarkably fertile field for the study of widespread engineering developments, but notes a lack of that spirit of scientific and technical inquiry which is essential to a continued engineering growth and evolution.

The Dark and Middle Ages afforded no such opportunities for engineering progress. The mas-

ter builder, architect, military engineer, or bridge builder, was primarily a master craftsman in the service of one of the many petty leaders of the day.

An important date in the rebirth of the engineering profession is that of the first organization of a corps of engineers in the French Army under the Marquis de Vauban in 1672. Parallel to this first modern recognition of the profession, the various finance ministers of France aided and encouraged the industrial and economic development of their country not, unfortunately, in the public interest but, primarily, with the desire to increase the royal income through taxation. Again the economic and political scene was unfavorable to a full fruition of the remarkable contributions which French engineers, usually members of the corps, made to technological progress.

During the rise of British leadership in the late 18th century, the engineer was still employed primarily on a personal, private consulting basis, but he worked under a democratic, rapidly expanding economy and with the further incentive to technical development provided by the new source of power, steam, and the new material of construction, iron. These conditions were continued on an even greater scale and with the unparalleled natural resources of a new continent when in the 19th century the United States became the most active engineering nation in the world. With the transformation of engineering into a science, the major factors which create a widespread engineering development were simultaneously present for the first time in the history of the world. Large populations under democratic rule in an expanding economy led to an unprecedented demand; and new materials, products, and techniques, the results of continuous work in scientific and technical research, give constantly increasing power to the engineer in meeting this demand.

Modern Practice in the United States.—The field of civil engineering, once defined as including all branches of engineering other than military, has come to include primarily the professional aspects of construction, a field which it shares in part with architecture. The civil engineer is engaged in the planning and design of works connected with transportation by railroad, highway, waterway or air, including railroad, highway and street location, bridges and other incidental structures, canals, rivers, piers and harbors, terminals and airports. The hydraulic field covers water supply for public or private use, water power, flood control, drainage and irrigation, as well as sewerage, and sewage and waste disposal. Various combinations of these activities are referred to as railroad, highway, structural, hydraulic, sanitary or municipal engineering. The civil engineer may also specialize in various steps in the stages of a project, such as investigation, design, construction, operation, or valuation. Modern construction has, in fact, become highly specialized, requiring skill in the planning and designing of plants, scheduling and direction of labor, and the development of construction methods and procedures.

While the civil engineer is thus principally concerned with capital investments in more or less permanent plants and works, he must also be able to select and utilize effectively the products provided by the other branches of the profession which are concerned primarily with

consumer goods, such as the materials of construction and industry (mining, metallurgical and chemical engineering), including steel, timber, concrete, and many other materials; the modern applications and use of steam, electric and gas power engines and machinery (electrical and mechanical engineering); and with the principles of production methods and techniques (industrial engineering). The education of the civil engineer therefore necessarily includes the fundamentals of all these other branches of engineering insofar as they enter into the planning, design or construction of civil works.

During the 19th century in the United States, the transportation problem, notably the railroad, dominated the engineering field, and the majority of civil engineers were employed in railroad work. Later in the century, urban problems became pressing. Many water supply works were carried out by private companies, but, as sanitation increased in importance, they were planned and designed as public works by private consulting experts. At the present time, the ordinary maintenance of municipal works is provided by public agencies, while consulting engineering firms are called upon for designs requiring special competence and experience.

River and harbor undertakings have long been important peacetime activities of the Corps of Engineers of the United States Army. In 1902 the United States Bureau of Reclamation began its extensive series of works, including such notable hydraulic constructions as Boulder, Grand Coulee, and other dams. At the turn of the century the Panama Canal was undertaken as a federal project, and the modern highway era was also initiated and developed on a state basis with federal aid and support.

While there has been increasing employment of civil engineers in public service, ever-increasing specialization still encourages the maintenance of private consulting offices. The tremendous demands for engineering services since World War II have likewise supported many private consulting firms. Engineering construction, almost invariably undertaken by private companies, has become, as noted, largely a specialized branch of the profession. Thus while many positions are available for civil engineering employment in public offices, the field still offers interesting opportunities for private initiative in railroad, industrial, and other activities, notably in specialized design and consulting services and in construction.

Education.—The earliest school for civil engineers was the École des Ponts et Chaussées, established in 1747 to train men to serve in the corps of the same name which was responsible for the building of the roads and highways of France. The first American school was at the United States Military Academy, West Point, which was organized in 1802 and remained entirely a school for army engineers until 1866. Norwich, Vt., 1819, and Rensselaer Polytechnic Institute, at Troy, N. Y., 1824, followed and, after 1860, a large number of schools was organized.

In general, a four-year course in civil engineering, based on high school graduation and leading, usually, to a B.S. or B.C.E., is standard. It has been recognized, however, that, with the constantly increasing requirements for more advanced scientific and technical instruction, plus a reasonable allowance of time for general educa-

tion, four years is inadequate. A few schools have turned to five-year courses, while many schools offer graduate specialization following the bachelor's degree.

The young man looking forward to civil engineering as a career must, therefore, plan to complete at least four years of collegiate study. Thereafter he will serve a period of apprenticeship in an engineering office or in the field, and, having proved his ability, obtained adequate experience, and been in responsible charge of important work, may then, after a minimum of usually four years following graduation, apply for examination for a professional license.

As in all professions based on science, the educational requirements have been constantly rising in civil engineering. Even in the positions of subordinate technical aides, such as surveyor, draftsman, detailer, or assistant designer, inspector, timekeeper, or assistant on construction, constantly higher degrees of technical competence and skill are essential. In particular, mathematical techniques and procedures are becoming more highly developed and involved, while, in almost all phases of practice, an ability to work with and direct others is essential. The newer fields of activity include such branches as airplane structural design, and similar specialties, based on the most advanced methods and techniques of applied mechanics, stress analysis and design, normally covered only in graduate courses.

Professional Societies.—The oldest professional group in the English-speaking world is the Institution of Civil Engineers of Great Britain, founded in 1818, with the famous Scottish engineer, Thomas Telford (1757–1834, q.v.) as its first president. In the United States, the Boston Society of Civil Engineers, organized in 1848, and the American Society of Civil Engineers (q.v.), founded in 1852, are the oldest engineering organizations. These organizations are predated, however, by the Corps des Ponts et Chaussées in France and by the Smeatonian Society, a small group centering about John Smeaton, in England. The various civil engineering specialties have also led to the formation of numerous special societies such as the American Society for Testing Materials (ASTM), which has been a leading influence in the development of standards and specifications for engineering materials; the American Railroad Engineering Association (AREA), the American Highway Association, the American Water Works Association, the American Concrete Institute, and various other organizations.

See also APPLIED MECHANICS; AQUEDUCTS; ARCHITECTURE, EDUCATION FOR; BRIDGE; BUILDING; CANALS; CONCRETE CONSTRUCTION; DAMS; EDUCATION, ENGINEERING; ELECTRICAL ENGINEERING; ENGINEERING; HYDRAULIC ENGINEERING; HYDRAULICS; IRRIGATION; MECHANICAL ENGINEERING; MILITARY ENGINEERING; MINING ENGINEERING; RAILWAY ENGINEERING AND CONSTRUCTION; RIVER ENGINEERING; ROADS AND HIGHWAYS; SANITARY ENGINEERING; WATER SUPPLY.

J. K. FINCH,

Dean Emeritus, School of Civil Engineering,
Columbia University.

CIVIL LAW. The term "civil" is derived from the Latin *civilis*, which means concerning or pertaining to a community, a city, or a state (*civitas*), or its citizens (*cives*). The expression

"civil law" has its predecessor in the *ius civile* of the Roman law in which it acquired various meanings in the course of time; none of them, however, covers what in modern English juristic terminology is called civil law. In the Roman world *ius civile*, in its earliest significance, was the legal order, the legal rules and institutions, the national law of the Romans (*ius proprium civitatis*) as first established in the law of the Twelve Tables (q.v.) of 451–450 B.C. and later developed through interpretations (*interpretatio*) by Roman jurists (men learned in the law) and juriconsults (after Augustus, persons licensed by the emperor to give legal opinions), and through specific laws (*leges* = statutes) issued in a constitutional way by the Roman people gathered in popular assemblies (*comitia*). To these sources of *ius civile* in its narrowest sense a classical jurist, Papinianus, added the decrees of the Senate (*senatusconsulta*) and even the enactments of the emperors. The earliest *ius civile* is also named *ius Quiritium* (Quiritarian law).

To the *ius civile* thus conceived as the national law proper of the Roman people the *ius honorarium*—the law created by the highest magistrates (predominantly the praetor), who were authorized to set new legal principles in their edicts—is opposed. In another sense, the *ius civile* appears as contrasted to the so-called *ius gentium*; while the latter denotes the legal norms which originating from commercial relations between Romans and foreigners later applied to relations among Roman citizens themselves, the former refers to Roman citizens and embraces legal institutions inaccessible to foreigners. Another contrast is *ius civile* versus *ius naturae* (*naturale*), the latter being the law which "natural reason" (*naturalis ratio*) created for all human beings, as opposed to the "civil" law arising from all kinds of legal sources.

Finally, the term *ius civile* occurs in the title of a few juristic treatises (*libri iuris civilis*), written in the late Republic and the early Principate (the most important by the jurists Quintus Mucius Scaevola and Massurius Sabinus), in which the presentation is not strictly confined to the *ius civile* in its narrow early conception; through occasional inclusion of some rules of the *ius honorarium* the term *ius civile* was here brought nearer to the general meaning of private law (*ius privatum*) regulating the relations of citizens to each other. It may be stressed, however, that in Roman sources *ius civile* does not appear as opposed to criminal law, as it is in modern juristic terminology, nor had it the meaning of the law of civilians as contrasted to the law concerning soldiers (military law).

In the late 16th century *ius civile* acquired quite a new connotation. The creation of an official collection of ecclesiastical laws, *Corpus Iuris Canonici* (the body of canon law) might have suggested the name *Corpus Iuris Civilis* (the body of secular [civil] law) which was given to Justinian's legislative work as a whole (the Institutes, the Digest or the Pandects, the Code, and the Novels). The title, which never had been used by the emperor himself, appeared for the first time in 1583 in the edition of Justinian's work by the French Romanist, Denis Godefroy (Dionysius Gothofredus). Here the word *civilis* was applied to the whole Roman law without regard to what the term meant in earlier times and in the codification itself. It comprised both private and public law, procedural, and penal

law, administrative and military law. From this denomination arose the modern English use of the term civil law.

Starting from the identification of the Roman law as embodied in Justinian's codification with *ius civile*, the term is currently applied to something quite different, namely, to legal systems in other countries in which Roman law was either accepted ("received," hence the term "reception" of Roman law) at any one time to be the law of the receiving country, or in which their codifications had been based on fundamental Romanistic principles and categories. This use of the term civil law is specific in the English language and Anglo-American legal terminology and has no counterpart in the juristic language of the countries whose law, in particular the private law, has its roots in Roman law. In French *droit civil* is identical with *droit privé*, without regard to its origin, Roman or other; in Italian *diritto civile* is synonymous with *diritto privato*; and a similar identity of these terms exists in some of the Slavic languages. German terminology applies both the term *Zivilrecht* and *Bürgerliches Recht*; in the latter expression *bürgerlich* is the exact translation of *civilis* (*Bürger* = *civis*). Hence the German code of private law is called *Bürgerliches Gesetzbuch* (BGB), while the official German title of the later Swiss Code is *Zivilgesetzbuch*. In all these non-English applications the word *civil* is used in contradistinction to criminal law on the one hand, and to commercial law on the other.

A similar inconsistency as existed in the Roman terminology occurs in English too. Thus civil law is frequently identified with private law in English juristic literature, to mention only the well-known two-volume textbook, Jenks' *English Civil Law*, 4th ed. (London 1947). The same was done by the Roman jurists, Mucius Scaevola and Sabinus, mentioned above. On the other hand, in English-speaking lands civil law more often is simply identified with Roman law, and university professors appointed for civil law teach Roman law proper. When seeking traces of Roman law in the English law, scholars often speak of civil law, and the identification of Romanist scholars as "civilians," which hardly can be considered fortunate, is not rare in literature.

Most European countries belong to the realm of civil law in its Anglo-American conception, except Soviet Russia and, nowadays, some of her satellites, insofar as they have recently modified their private legal systems after having lived for long periods under Romanizing codifications.

Central, Western, and South Europe are in general under the civil law regime. Those European countries whose civil codes served afterward for other countries' codifications are the typical representatives of the so-called civil law system, including such national codes as the French Civil Code (*Code Civil* or *Code Napoléon*, 1804); the Austrian Code (1811, *Allgemeines Bürgerliches Gesetzbuch* = the General Civil Code); the Spanish Code (1886); the German *Bürgerliches Gesetzbuch* (published 1896, in force since 1900); the Swiss Civil Code (1907, in force since 1912) on which the Turkish civil legislation (1927) is based. The latest European codification in this group is that of Greece (1940, in force since 1946). Among other European countries Scotland deserves particular mention.

Many non-European lands have systems which are likewise based on the civil law. Thus, in Asia: China (1911), Japan (whose civil code is based on the German code), Ceylon, the Philippines, Thailand (1925), Lebanon (1933), and others; in Africa: Tunisia, Morocco, Algeria, Union of South Africa (its law is called Dutch-Roman law because of the influence of Netherlands jurists on its development); in America: all the South and Central American countries, Mexico, Cuba, Haiti, Dominican Republic, and Puerto Rico, the Province of Quebec in Canada and, in the United States, the State of Louisiana (with a code which adopted the French *Code Civil* with addition of Spanish elements).

In the so-called civil law countries (more than one third of the world) differing economic, social, cultural, political and historical backgrounds have conduced to a great variety of modern legal systems through progressive legislative enactments. Consequently it is inappropriate to designate all these variant systems by such an all-embracing term as "modern Roman law"; although that loose term continues in current use, it is objectionable as misleading.

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